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OBSERVATIONS OF THE CENTRAL ECLIPSE OF THE SUN OF APRIL 28, 1930, AT HONEY LAKE, CALIFORNIA

By ISABEL M. LEWIS.

The eclipse of April 28, 1930, was not regarded with favor by astronomers prior to its occurrence. Veteran eclipse observers shook their heads skeptically at the idea of obtaining observations of any value from an eclipse that had a duration of totality of less than one and a half seconds.

The extreme narrowness and uncertainty in position of the path, which was less than three-quarters of a mile in width at maximum, was one of the discouraging things about this eclipse.

The uncertain value of the correction to the moon's mean longitude loomed large as a factor to be considered. An error of 1".5 in the value of this correction would offset the path by more than its own width.

From the reduction of a series of observations of occultations made at the U. S. Naval Observatory in 1929, and up to March 12 of 1930, and from meridian observations of the sun made at the same Observatory in 1929, Mr. James Robertson, Director of the *American Ephemeris,* had determined the values of the corrections to the positions of the sun and moon to be used in a recalculation of the eclipse path which had been originally computed four years earlier, with an extrapolated value of the correction to the moon's mean longitude and no correction to the position of the sun. Copies of the revised path with the correction for altitude above sea-level had been mailed a month in advance to all leading observatories and to many individuals who might be interested. This altitude correction amounted to more than the width of the path at 4,000 feet elevation. There was also the effect of irregularities in the form of the lunar disk to consider. It is believed that the moon is somewhat oval in shape and it was known that the disk would be rough and serrated in outline as the Hercynian Mountains on the northeast limb abound in lofty peaks several miles high and the Doerfel Mountains on the southeastern limb include peaks exceeding 26,000 feet in height while the Leibnitz Mountains on the southern limb have many giant peaks equally high. It was probably valleys of these three Mountain Chains that formed the five conspicuous Baily's Beads that were to be seen at mid-totality.

Considering the difficulties of the problem, it might seem futile to travel across the continent and stake one's chances on securing, within a path only five-eighths of a mile wide, a photographic exposure of only one second's duration; all to test out the accuracy of an astronomical

prediction and the correctness of the data upon which it was based. Yet the very difficulties of the problem made it attractive. To borrow the expression used by Professor Michelson in speaking of his velocity of light experiments, it promised to be "good fun" and if we were successful the results would have a scientific value. Moreover it would mean that there would be no break in the series of eclipses observed by astronomers of the U. S. Naval Observatory in recent years, as a member of the staff of the Naval Observatory will soon take part in an expedition to the Island of Niuafóu in the South Pacific to observe the eclipse of October 21-22, 1930.

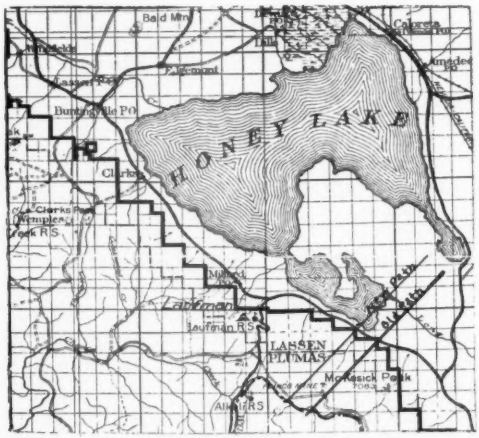


FIGURE 1.
Site of Eclipse Camp at Honey Lake, California, showing original and revised paths, corrected for elevation of 4,000 feet.

Although our trip was not official in any sense, Captain C. S. Freeman, then Superintendent of the U. S. Naval Observatory, coöperated most helpfully with us in permitting the use of the 4.6-inch lens and telescopic camera box which has frequently been used on Naval Observatory eclipse expedition and, in addition, provided us with a wooden mounting for this camera which was a great aid to us upon our arrival at our station as it did away with the necessity of securing carpenter service there. It was in obtaining the coöperation of two Naval planes from the U. S. Naval Air Station at San Diego, California, however, that Captain Freeman contributed most to the success of our undertaking. The splendid film of the eclipse which Photographer W. A. McDonald, U.S.N., obtained on the ground, with the Akeley Motion Picture Camera, about twenty feet distant from the position of the telescopic lens with which we secured a photograph, furnishes proof that

our station was actually within the true path of the moon's shadow. It is therefore certain that the corrections to the moon's mean longitude and the correction to the longitude and latitude of the sun derived by Mr. Robertson and used in the revision of the eclipse path early this spring must have been very close to the true values of these corrections.

Some weeks before leaving Washington, and while still unsettled as to the exact location of our eclipse site, we were fortunate in securing from the Forest Service in Washington, an exceptionally fine large scale map of the Plumas National Forest in California, scale one mile to the half inch, and upon plotting the eclipse path upon this map, corrected for 4,000 feet elevation, we found that at a distinctive point in the boundary of the Plumas Forest it crossed a highway which leads from Susanville, California, to Reno, Nevada, along the shore of Honey Lake. We decided, therefore, to make this point our objective.

Upon visiting the Mt. Wilson Observatory on our way to Honey Lake we were told that the Mt. Wilson expedition had been in the vicinity of Honey Lake for about two weeks, so we were not surprised when we arrived at our tentatively selected site to find it already occupied by the well-equipped camp of the Mt. Wilson eclipse party! Dr. S. B. Nicholson kindly compared the plot of the path on our map, corrected for elevation of 4,000 feet, with his own determination of position, which was based upon the same revised data as our own, and found that they were in agreement.

FIGURE 2.
The Sikorsky Amphibian Transport PS2 and the Land Plane 02U1 at Honey Lake, California.

We then took a position a few hundred feet to the northeast of the Mt. Wilson camp in line with it and the marks which they had used to indicate the position of the predicted path. Both stations were on the dried-out, alkali flats, free of trees and shrubs, that formed the shores of Honey Lake. This was an ideal landing place for planes and here we were met by Lieutenants Gehres and Harvey and their party on the early morning of the day preceding the eclipse. Extremely bad flying conditions had prevented their arrival on the previous day.

Lieutenant W. W. Harvey, U.S.N., who piloted the Sikorsky amphibian transport, took our party of seven in a short flight along the predicted path of the moon's shadow over Honey Lake and its surroundings on the day preceding the eclipse that we might be familiar

with the landmarks if it should be necessary to identify them in a film showing the path of the shadow over the ground. Unfortunately the clouds which nearly defeated our plans, and in fact cast a thin veil over the eclipsed sun at totality, prevented Lieutenant Gehres and Chief Photographer Haase from photographing the shadow on the ground though they observed it on the clouds. First contact occurred in a clear patch of sky. Only twenty minutes before totality, however, it looked as if our view were to be obstructed by clouds while on the opposite shore of the lake the sky appeared to be clear. Lieutenant Harvey suggested that it might be advisable to transport our party and equipment across the lake, which could be easily accomplished in five minutes. This we were prepared to do at a moment's notice. Lieutenant Harvey then made a hasty trip across the lake, but before his return a large patch of clear blue sky appeared around the sun and success seemed assured. Yet a thin veil was forming over the sun at totality and five

FIGURE 3.
Lieutenant Gehres and Chief Photographer Haase taking off in the Land Plane, equipped with Akeley Motion Picture Camera, to photograph the Moon's Shadow.

minutes after, the sun was completely covered by a dark cloud. It may be due to the presence of these clouds that no corona was seen, or possibly it was due to the brilliancy of the sunlight coming through the five lunar valleys visible during totality. Certainly, as a scenic feature, the eclipse was a disappointment due to the absence of the corona as well as any clearly marked shadow bands. This was in great contrast to the eclipse of January 24, 1925, when we saw a most magnificent display of shadow bands on the snow. A most interesting feature of the eclipse of April 28, however, was the appearance of Baily's Beads, apparently running rapidly around the disk, all within a second or so. In our attempt to catch the corona, which did not appear, and while waiting for the disappearance of the Beads, we delayed a second or so too long to get complete totality and the reappearing solar crescent is visible in our photograph taken with the 4.6-inch lens. The motion picture film, however, obtained by Photographer McDonald, faithfully recorded a most interesting breaking up of the crescent and the appearance of the five

lunar valleys at mid-totality. It was estimated that the eclipse became total within less than two seconds of the predicted time.

In addition to the photographs of the eclipse obtained on the ground, Lieutenant Leslie E. Gehres, U.S.N., and Chief Photographer J. M. T. Haase, U.S.N., in a pursuit plane at 18,000 feet obtained a fine film of the approach of the moon's shadow on the clouds at 12,000 feet elevation under most trying conditions.

Lieutenant Gehres and Chief Photographer Haase reported upon their return from photographing the moon's shadow that they had seen it as "an elliptical, purplish-to-black spot on the clouds at an elevation of 12,000 feet above sea-level, darker than the surrounding dusk, and

FIGURE 4.
Chief Photographer J. M. F. Haase, U.S.N., (left) and Lieutenant Leslie E. Gehres, U.S.N. (right).

from one-half to three-quarters of a mile wide and that it had seemed to pass almost instantanously across the clouds about one mile south of the predicted path." This difference in position was due to the fact that at an elevation of 12,000 feet above sea-level the altitude correction would shift the position of the path to the southeast. The calculated amount of the shift is nearly eight-tenths of a mile. The observed shift in position was stated to be about one mile. This gave a further check upon the correctness of the predicted path and the data upon which it was based.

We wish to take this opportunity to express our appreciation of the splendid spirit in which the Aviators, Photographers, and their crew coöperated with us in the observations of the eclipse, and to give them

credit for obtaining the most valuable part of the observations of this eclipse. Our thanks are also due to Mr. George H. Peters, Senior Astronomer of the U. S. Naval Observatory, for developing our photographs of the eclipse upon our return to Washington.

U. S. Naval Observatory, Washington, D. C.

THE McMATH-HULBERT TELECHRON DRIVING CLOCK
For Moderate Sized Equatorial Mountings

By ROBERT R. McMATH.*

The writer is one of a group of three men, consisting of Francis C. McMath, Consulting Engineer, of Detroit, Michigan, (the writer's father), Judge Henry S. Hulbert, Senior Judge of Probate, of the same city, and himself. All three of us had the honor to be appointed Honorary Curators by the Regents of the University of Michigan. The writer was selected, by a majority of two to one, to attempt to describe the experiments leading up to the design and installation of telechron driving clocks for equatorial mountings.

We were using a 4-inch Bausch & Lomb telescope during the years 1927 and 1928. This telescope was factory-equipped with a double spring driving clock. This piece of apparatus was perfectly satisfactory until a sidereal or setting circle was installed, early in the spring of 1928. We found that we were re-setting the circle at least twice an hour and, of course, investigation showed that the greater part of the error was in the clock. This clock was completely adequate for short visual observation, but its rate was not sufficiently constant to permit continuous use of the sidereal circle.

On the work table in the dome was a telechron clock of standard make and design. This clock was used in the dome as a mean time clock and was set periodically by radio time signals from Arlington. Due to the fact that we were operating it in the "Controlled Zone" of the Detroit Edison Company, the clock error was rarely as much as a second and its average error was probably much less.

The Warren Telechron Company, of Ashland, Massachusetts, manufactures several types of telechron motors, one of which is used in the telechron clock sold by most jewelers. The telechron motor is a synchronous motor of such special design that its speed, and hence, the speed of any timing mechanism that it drives, is directly and solely dependent upon the frequency of alternating current. The manufacturer claims that the motor is not affected by temperature changes between 20° and 120° F. All the moving parts are in a sealed case, air-tight and dust proof, and permanently lubricated. The motor is compact, self-

*Honorary Curator of Astronomical Observations, University of Michigan Observatory.

starting under load, and comes up to synchronous speed practically instantaneously. They are timed to frequencies of 60 cycles per second. Information concerning other frequencies should be requested from the manufacturer.

Mr. Francis C. McMath suggested that, if one of the telechron motors had sufficient power, it would make an excellent motor with which to drive the clock for the telescope. This suggestion was taken up and for some time we endeavored to devise ways and means of transforming the mean solar rate into sidereal. Correspondence with the Warren Telechron Company indicated that this could be done, but would probably be very expensive.

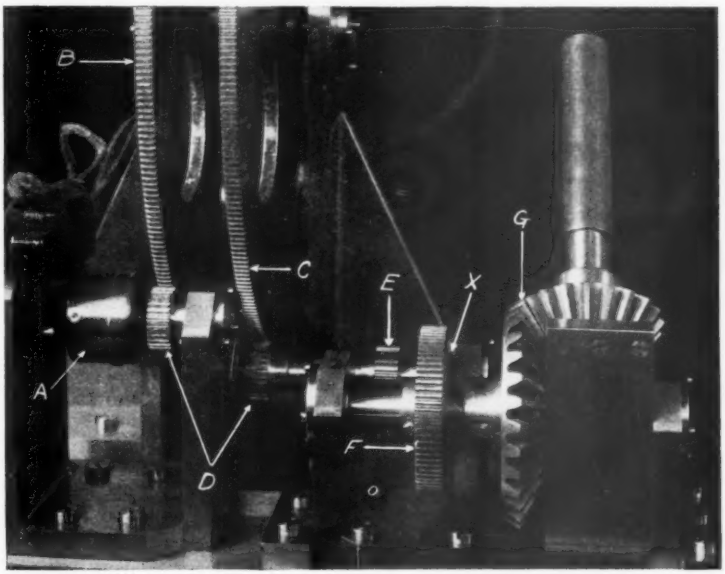


FIGURE 1.

A = Telechron Motor.
B = 365 Tooth Gear.
C = 366 Tooth Gear.
D = 30 Tooth Pinion.
E = 28 T Sidereal Pinion.
F = 80 T Drive to Bevel Gears.
G = Bevel Gear Drive to Worm.
X = 27 T Lunar Pinion in Mesh (behind).

In looking over the table of constants, which is on one of the first few pages of *The American Ephemeris and Nautical Almanac*, we note the length of the year in mean solar days and in sidereal days. It occurred to us that the error would not be very great if two gears were cut, one with 365 teeth and the other with 366 teeth, and mounted on the same shaft.

Two telechron motors were secured, which were mounted so as to drive the 365-tooth gear by means of 15-tooth pinions. The worm wheel

on this particular telescope had 360 teeth, therefore the desired reduction was 4 to 1. There are, of course, 1440 minutes in a day, and the motor makes one revolution per mean time minute. In order to drive the telescope at the rate of one revolution per day, the motor should make four revolutions for each tooth in the worm gear. Power was

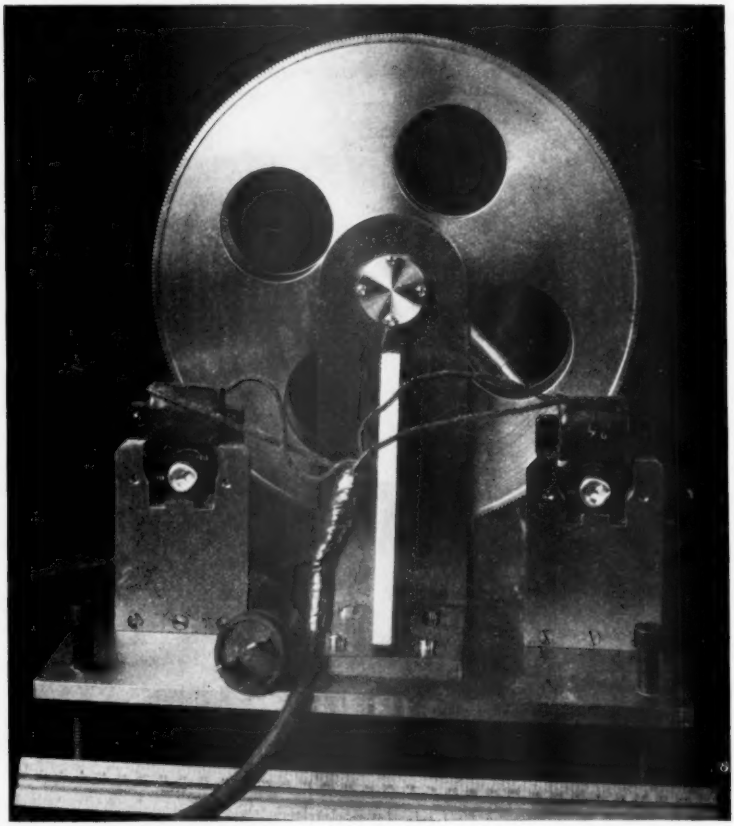


FIGURE 2.

taken from the 366-tooth gear with a 30-tooth pinion, and outside of the clock, final reduction was made by a 26-tooth pinion driving a 52-tooth gear attached to the worm itself.

With fear and trepidation, the clock was installed and, on the first clear night, actual tests were made on a star. The mount had been very carefully put in position and on our first test we were unable to find any drift in right ascension during the period of an hour. This clock was,

at that time, driving about ninety pounds, with a total of 4 watts of power. This installation was completed in July, 1928, and gave entire satisfaction.

During April and May of the year 1928, the writer and his father discussed the desirability of having an 8-inch or 10-inch reflector built by J. W. Fecker, of Pittsburgh, Pennsylvania. During a visit to Mr. Fecker in his workshop, on May 10, 1928, we suggested to him the use of the telechron motor and "sidereal gears," in connection with this proposed telescope. Mr. Fecker, at this time, evidenced his interest and thought it worthy of experiment. In January, 1929, we decided to build a 10-inch Cassegrain reflector. With the assistance of the late Dr. Ralph H. Curtiss, Director of the Observatories of the University of Michigan, the optical constants were decided upon and the mirrors ordered from J. W. Fecker. The tube and eye end were built in the shops of the Motors Metal Manufacturing Company, of Detroit, Michigan, of which company the writer is President. Our plan was to mount this 10-inch reflector on the old 4-inch Bausch & Lomb mounting in our dome at Clarkston, Michigan. We were not certain whether or not our 4-watt telechron clock would drive the new tube and counterweights, but decided to try it. It is now a matter of record that the 4-watt clock walked away with 165 pounds of tube and counterweights on totally inadequate ball bearings.

During the summer of 1929, Dr. Ralph H. Curtiss visited the writer at his summer home in Clarkston, and was immensely taken with the telechron driving clock. He was, at that time, building a Bruce type photographic mounting for the University's 15½-inch Pyrex Cassegrain reflector, to go in the north dome of Angell Hall Observatory. By this time we were already building two mountings from the same set of patterns. The University men planned to place their 15½-inch mirror on their mounting and we were planning to install the 10-inch mirror and tube in position on our mounting. We have also mounted the old 4-inch tube on top of the 10-inch, for use as a guide telescope. After Dr. Curtiss reached his decision to use a telechron driving clock, two of them were started in the University Observatory shop.

Mr. H. J. Colliau, Superintendent of Instrument Construction at the Observatory in Ann Arbor, completed the first clock of this pair on Friday, January 17, 1930. This clock was brought to Detroit, where it was installed by the writer in the mounting, which was practically complete at that time. Some changes in design had been made and this clock is a much more finished product than the one previously described.

Two 6-watt motors are used to give a total torque of 2.0 inch pounds. The moving parts of the present mounting weigh approximately 850 pounds. We were delighted when the motors started up at the turn of the switch and drove the telescope continuously and smoothly. There is also sufficient power, so that the clock does not stop when the telescope is moved by hand in right ascension against the clock. We have,

as yet, been unable to test on a star, but with the quality of workmanship on this clock, we believe it should drive better than the first experimental clock.

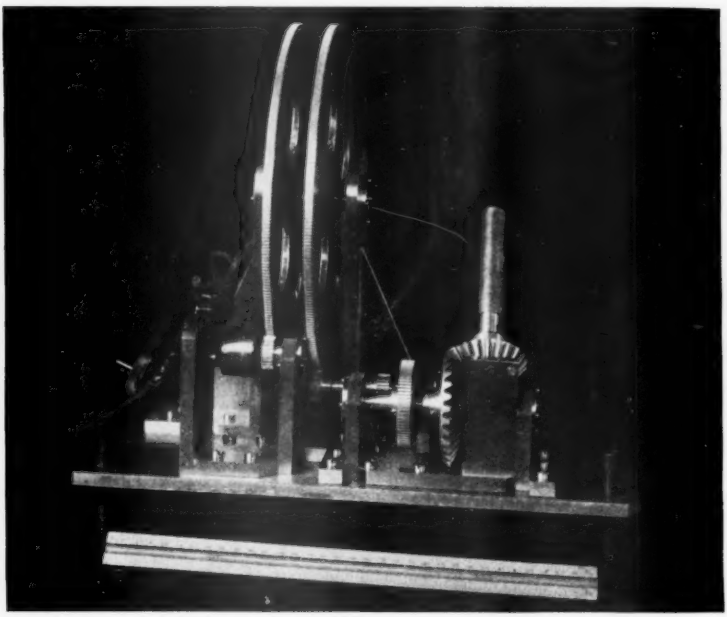


FIGURE 3.

For the following figures on the sidereal rate, the writer is indebted to Dr. Ralph H. Curtiss, of Ann Arbor:

$$\frac{\text{“}366.242}{365.242} = 1.0027378$$

$$\frac{366}{365} = 1.0027398.$$

Thus the error involved in using the latter ratio is one part in 500,000 or one-tenth of a second per hour. Such gears should be sufficiently accurate for large telescopes.”

We believe the accompanying photographs will illustrate the extreme simplicity of this clock. Compared to a standard astronomical driving clock, there are very few gears and all of these gears are of the spur type, which are easier to cut and mount than bevel gears. It has an important saving in regard to size, inasmuch as there is no driving drum and no weight system required. It can probably be built for about one-third of the cost of a standard driving clock. While to date we have

used only two motors, it is possible to install almost any number of them. We are informed that the Warren Telechron Company makes these motors with a torque of 2.0 inch pounds each.

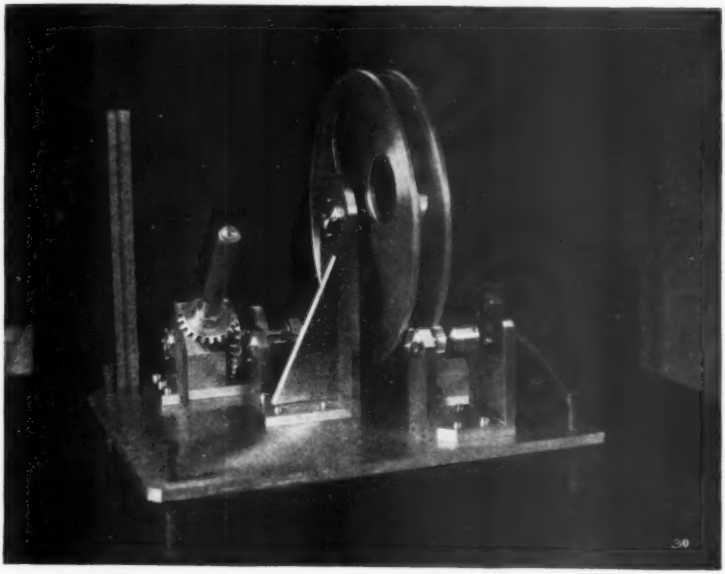


FIGURE 4.

If our readers inspect the photographs closely, they will notice that in the final drive there are two pinions, E and X, either of which can be meshed with the 80-tooth gear, F. The worm on our 15-inch mounting has 504 teeth, which results in a final drive of 28 to 80. In this case, pinion E has 28 teeth and pinion X has 27 teeth. This 27-tooth pinion will give a reasonably close approximation of the lunar rate. This change is easily effected by shifting the 80-tooth gear on a splined shaft.

For the purpose of relieving the load on the little telechron motors, the bearings on these clocks are SKF self-aligning ball bearings—this may not be necessary and nicely fitting bronze bearings might be satisfactory and would be less expensive. We thought it better practice to reduce the friction at every possible point.

For those who may be contemplating the construction of one of these clocks, it would be well to re-state the fact that the clock's accuracy arises from the care with which the Detroit Edison Company, in this locality, controls the number of cycles per second. Before building a clock, the local power company should be consulted as to the accuracy with which they control the cycles per second.

The reader may also note that this clock may be adapted for driving

at the solar rate, with simple changes which would not affect its sidereal or lunar driving rate.

NOTE: Since the above was written (January, 1930) the telescope has been in service at our observatory at Lake Angelus, Pontiac, Michigan, for three months, doing exacting work in celestial and lunar photography. We are delighted with the performance of the clock. It has met all tests satisfactorily. After correspondence with the Warren Telechron Company, we changed the two 6-watt motors to 12-watt motors, giving us a total torque of 4 inch pounds and now we do not have to be particular about our balance. Our camera equipment has increased the weight of the moving parts to over 1000 pounds.

LIGHT-CURVE AND ORBIT OF THE ECLIPSING BINARY ZZ AURIGAE

By W. W. MORGAN.

The star B.D. +41°1265 was found to vary by Furuhjelm[1] in 1917. The photographic magnitudes at maximum and minimum were given by him as $9^M.68$ and $10^M.96$. No period was given nor was the type of variation found. The variable was later assigned the name ZZ Aurigae. Its position for 1900, according to the *Astrographic Catalogue*, is

$$\alpha = 5^h\,38^m\,38^s.54 \qquad \delta = +41^\circ\,6'\,25''.2.$$

The field of the variable is shown in Figure 1.

During the winter of 1928-9, 276 observations of the variable were made with the newly mounted 12-inch twin telescope of the Yerkes Observatory. The observations were made by the method of Argelander, with the following modifications: A diagonal eyepiece was used, by means of which the field could be rotated to any position. For the first observation the field was turned until the line joining the variable with the comparison star c was parallel to that joining the eyes when they were in a level position. The variable was then compared with a star brighter and one fainter than itself, care being taken to keep the inclination of the head constant. The whole field was then rotated 180° until the line joining the variable and c was again parallel to that joining the eyes, with c on the opposite side of the variable. In this position the second observation was made, using the same two comparison stars as before. This procedure was repeated throughout the whole series of observations. In the reduction every direct observation was combined with the following reverse one. It is believed that this method considerably lessened the errors of observation due to the position angle of the comparison stars.

The scale of the comparison stars was determined by 55 sequences in steps, the field again being rotated 180° after each observation. This scale was compared with a scale of magnitudes determined from a plate

[1] *Astronomische Nachrichten*, **209**, 47, 1919.

taken by F. E. Ross using a short focus lens of his own design, on yellow sensitive plates through a photovisual filter. The plate included the field of the variable and Kapteyn area 25 of zone +45°. The magnitudes in the Kapteyn area had been determined by J. A. Parkhurst.[2] It was found that one step of the visual light scale was equal to one-tenth of a magnitude as closely as could be determined. The magnitudes of the

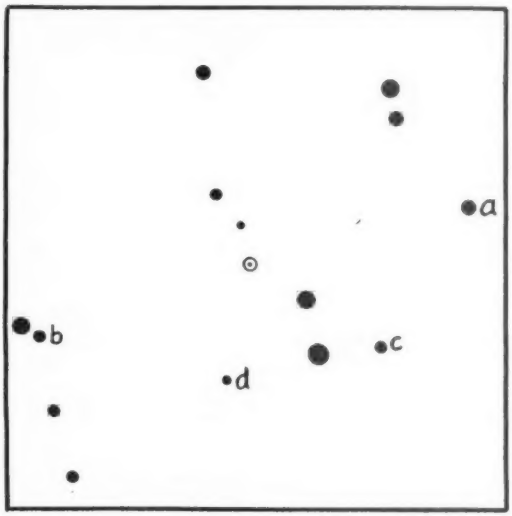


FIGURE 1.
FIELD OF VARIABLE, 30′ SQUARE.

comparison stars were thus deduced. A plate taken by Mr. Ross simultaneously with the photovisual one with blue sensitive plates without a filter, was used to determine rough color indices of the variable and the comparison stars. The visual magnitudes and approximate color indices of the variable and the comparison stars are given in Table I.

TABLE I.

	Mag.	Color Index
Var.	.....	0.0
a	10.21	+0.9
b	10.84	+1.0
c	11.44	+0.2
d	11.80	+0.1

A small difference in scale was found on comparing observations made on bright moonlight nights with those made when there was no moon. This was probably caused by the yellow color of the two brightest comparison stars. The observations were reduced to a common scale before

[2] *Publications of the Yerkes Observatory*, **4**, Part 6, 1927.

the final light-curve was formed. From the fact that the color index of the variable is approximately zero, it is probably of spectral type B or A. The elements of variation of light are

$$\begin{aligned} \text{Hel. Min.} &= \text{J.D. } 2425590.961 + 0^{d}.6014 \cdot E \quad \textit{G.C.T. (U.T.)} \\ &= \qquad 2425590.461 + 0.6014 \cdot E \quad \textit{Old G.M.T.} \end{aligned}$$

The observations were grouped in 32 normal places. These are given in Table II. The observed minus computed values in the last column were found from the orbital elements determined on the assumption of uniformly illuminated stellar disks.

TABLE II.

Phase	Mag.	O — C	Phase	Mag.	O — C
d	M	M	d	M	M
—0.231	10.51	+0.01	+0.064	10.65	—0.05
— .198	10.45	+ .02	+ .072	10.58	+ .01
— .167	10.40	— .01	+ .094	10.55	+ .03
— .136	10.44	+ .02	+ .125	10.48	+ .05
— .113	10.46	— .01	+ .172	10.40	— .01
— .101	10.52	.00	+ .192	10.42	+ .01
— .081	10.57	— .01	+ .209	10.48	+ .03
— .064	10.72	— .02	+ .220	10.46	— .02
— .040	11.15	— .04	+ .230	10.53	+ .02
— .030	11.36	— .03	+ .241	10.55	+ .01
— .018	11.60	.00	+ .251	10.56	— .02
— .005	11.63	+ .02	+ .270	10.71	+ .06
+ .002	11.61	.00	+ .283	10.74	+ .06
+ .024	11.43	— .07	+ .296	10.69	+ .01
+ .036	11.15	— .02	+ .314	10.71	+ .03
+ .048	10.85	— .08	+ .345	10.55	— .03

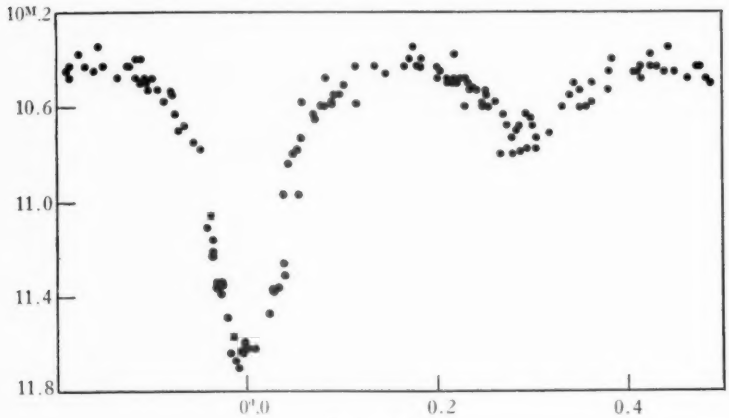


FIGURE 2.
OBSERVATIONS IN PAIRS.

Figure 2 shows the observations in pairs, and Figure 3, the mean places. The curve in Figure 3 is computed from the orbital elements.

Table III gives the final orbital elements computed from the light-curve. The method developed by Fetlaar[3] was used for the solution. As the curve computed on the assumption of uniformly illuminated stellar discs represented the observations satisfactorily, no other solution was attempted.

TABLE III.

Magnitude at maximum	M	10.41
Magnitude at primary minimum	m_1	11.61
Magnitude at secondary minimum	m_2	10.68
Semi-major axis of large star	a_1	0.58
Semi-major axis of small star	a_2	0.27
Semi-minor axis of large star	b_1	0.45
Semi-minor axis of small star	b_2	0.21
Polar axis of large star	c_1	0.42
Polar axis of small star	c_2	0.20
Light of large star	L_1	0.44
Light of small star	L_2	0.56
Inclination of orbit	i	82°
Coefficient of ellipticity	z	0.36
Density of large star	ρ_1	0.017
Density of small star	ρ_2	1.6
Hypothetical parallax of system	π	0".002
Ratio of surface brightnesses of two stars	J_b/J_z	6

The relative dimensions of the two stars are given in terms of the radius of the orbit. The densities were computed on the assumption of equal masses for the two stars. The parallax was determined considering the stars to be of spectral type A0.

The observations seem to show that the two maxima are shifted toward secondary minimum by an appreciable amount. This shift is

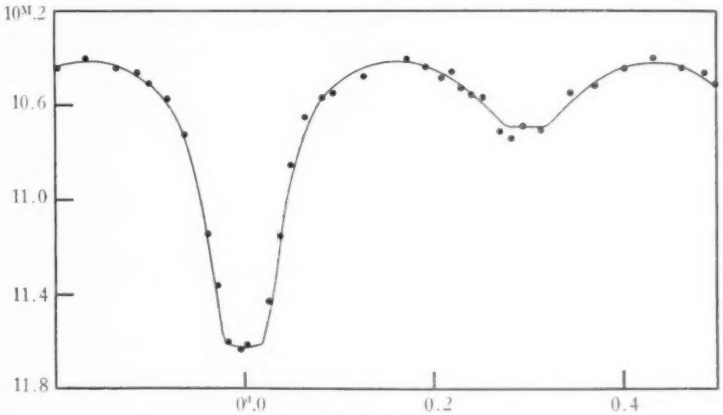


FIGURE 3.
NORMAL PLACES AND COMPUTED CURVE.

[3] *Recherches Astronomique de L'Observatoire D'Utrecht*, **9**. Part 1, 1923.

probably real, and has been interpreted as an effect of reflection and heating. Such a phenomenon would also be present if the orbit were eccentric with periastron on the opposite side of the orbit in the line of sight, but a measurable eccentricity would be improbable in a binary having such a short period.

The probable error of a normal point is $\pm 0^{M}.022$.

YERKES OBSERVATORY, WILLIAMS BAY, WISCONSIN, JULY 12, 1929.

NOTE ADDED SEPTEMBER 17, 1930: While the above paper was in the hands of the editors, preliminary elements of light-variation have been published in *Beobachtungs-Zirkulare*, 56, 1929, by D. J. Martinoff. He found the elements

$$\text{Hel. Min.} = \text{J.D. } 2425504.497 + 0^{d}.60119 \cdot E.$$

In a later paper in *Publications of the University Observatory, Kazan*, 26, 1930, by the same author, revised elements are given based on 277 of his own observations and 69 made by A. D. Dubiago. The revised elements are:

$$\text{Hel. Min.} = \text{J.D. } 2425504.496 + 0^{d}.6012006 \cdot E.$$

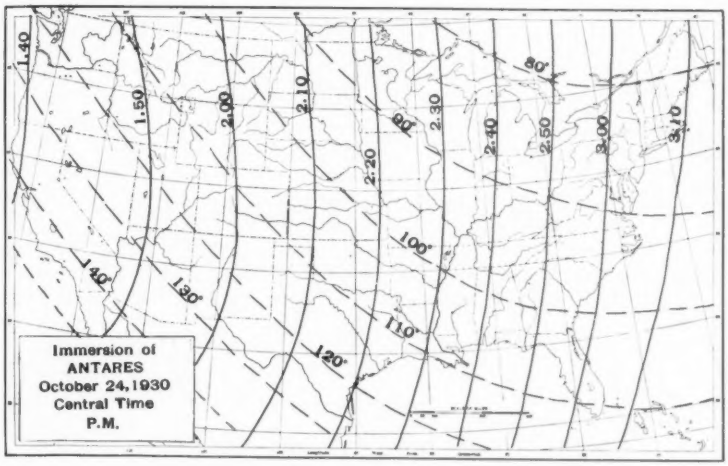
As these elements are based on observations over the interval 1928-30, they are more nearly accurate than mine. The agreement in phase with my light-curve is satisfactory. Martinoff finds that the magnitude at maximum is $10^{M}.61$, at primary minimum, $11^{M}.42$, and at secondary minimum, $10^{M}.75$. His maxima are flat, but he states that the long duration of the minima suggests that the star is of the β Lyrae type and that the poor arrangement of comparison stars when the variable is bright prevented the maxima from appearing round.

OCCULTATION OF ANTARES, OCTOBER 24, 1930

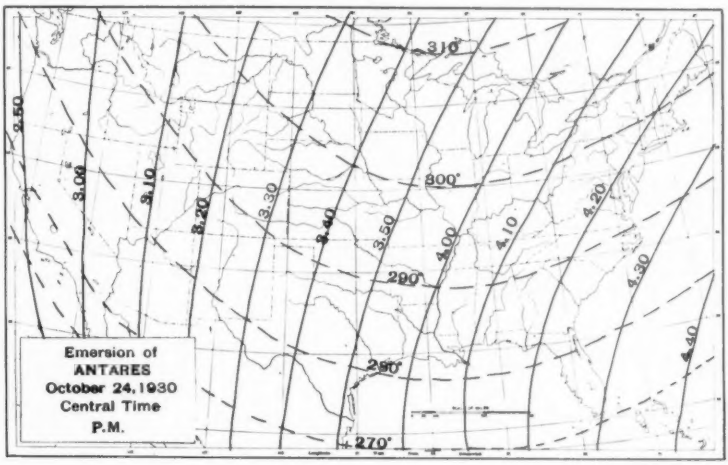
By WM. CLETUS DOYLE, S. J.

This second occultation of Antares for 1930 will be visible throughout the United States; but occurring as it does in midafternoon it will not be nearly so spectacular. Under good conditions it may be visible to the naked eye, but in general either a pair of field glasses or a telescope will be necessary. Accurate observation of the reappearance will be almost impracticable, for it will take place on the bright limb of the moon.

The times of immersion and emersion can be obtained from the accompanying charts with accuracy of a minute or two. The continuous lines give the central time of the occultation at ten minute intervals, the immersion ranging from 1:40 in the West to 3:10 in the East, the emersion from 2:50 to 4:40. Observers not situated directly on the lines can



compute the time for their place by interpolation. The broken lines give the position angle, that is, the number of degrees the occultation will occur from the north point of the moon.

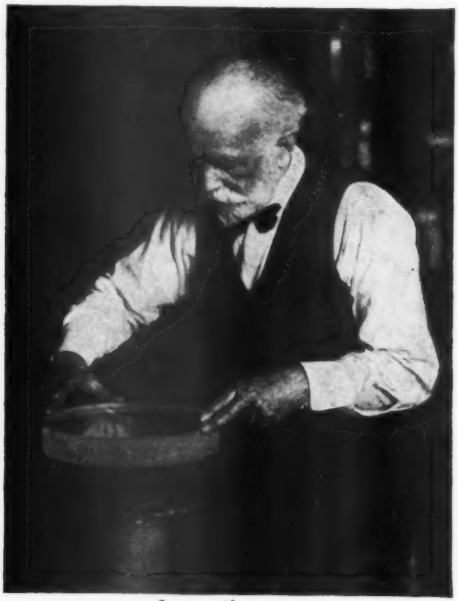


The magnitude of Antares is 1.3.

Creighton University Observatory, Omaha, Nebraska.

JOHN CLACEY—OPTICIAN

AN APPRECIATION OF HIS HALF-CENTURY OF DEVOTION TO THE ART OF LENS MAKING BY MEMBERS OF THE STAFF OF THE NATIONAL BUREAU OF STANDARDS.



JOHN CLACEY.

There are many kinds of art and many varieties of artists. Painter, sculptor, architect, musician, poet, are all artists and fortunately it is possible for everyone to appreciate their contributions to humanity. But there are other artists whose work is of such a nature that it is but little understood by the uninitiated. The real reward for their labors is the satisfaction which comes from the consciousness of work well done.

Astronomy stands unique among the sciences in that it requires in its every branch the temperament of the artist, enthusiasm, perseverance, infinite patience, and, above all, a love of art for its own sake. This applies not only to the art of observing, recording, and interpreting what is to be seen in the heavens, but to the construction of the instruments by which these observations are made possible. It would indeed be a difficult matter to decide which is the greater artist, the maker of a first-class lens or the observer who uses it and, on the basis

of his observations, gives to humanity a new and more beautiful conception of the universe.

One of the last of the old-time makers of fine lenses is Mr. John Clacey, living at Glendale, Maryland, near Washington. Mr. Clacey was born in Northampton, Mass., in 1857, and his early life was spent in Boston. He received no special scientific training during his school years and had no thought of entering scientific work. In fact his first position was with a furniture manufacturing concern where his artistic ability showed itself in the decorations which he painted on the fine furniture of that period. While he was engaged in this work, in the late seventies, he became acquainted with a young man who was greatly interested in astronomy and who was the fortunate possessor of a five-inch refractor made by Clark. On every possible occasion these two young men set up the telescope on Boston Common or in back yards and alleys, in fact in every place where they could obtain a little "sky room," and explored the mysteries of the heavens. It was not long before Clacey had become an even greater enthusiast than his friend and had acquired a good knowledge of the constellations and the rudiments of practical astronomy. He decided that he must have a telescope of his own, but with his limited means he was in a quandary as to how to procure it. However, he attacked the problem in a truly scientific way. He visited the Boston Public Library and consulted all books he could find on the subject of telescopes and lens making. Certain branches of the subject were not adequately treated in the books available, but through a wise provision which exists in this institution, the librarian is provided with a special fund from which to buy books for any user of the library who is studying some particular subject. Clacey suggested several works published abroad and they were secured for him by the librarian.

He then visited New York City and purchased two disks of imported glass suitable for a 6-inch lens. With these two disks he commenced the task of making his first telescope. As was to be expected, he encountered numerous difficulties not mentioned in the textbooks and as he states it, his efforts resulted in "failure after failure." In fact after nearly a year of labor he found that he had reduced his disks to such thin pieces of glass that they bent under the pressure of his hands and were useless for lens making. However, not discouraged by these initial failures he secured a second set of disks and from these succeeded in producing a first-class achromatic objective which would divide certain test stars given in that indispensable handbook of all amateur astronomers, Webb's "Celestial Objects."

During his experiments Clacey had first followed the formulas for the production of objectives given by Fraunhofer, Gauss, Steinheil, and others, but, as he expresses it, "these formulas did not work," i. e., lenses ground and polished to the curves required by the formulas did not give satisfactory images. It was then that he first tried the method he ever afterwards followed in the production of optical surfaces, that

of removing zones by local correction, checked by constant testing with an artificial star. In Clacey's opinion no method of ordinary measurement is sufficiently sensitive to give the lens maker the information he requires. Even if it were possible to make the required measurements their interpretations would be extremely difficult. The work of lens making seems to demand a peculiar combination of sense of touch, muscular control, and ability to interpret certain indications given by the glass itself. In fact, almost a sixth sense is developed, so that every faculty of the lens maker is brought to bear on the problem in hand, just as the great painter or musician must enter heart and soul into the work on his canvas or at his instrument.

During the construction of his first telescope Clacey had become acquainted with numerous professional and amateur astronomers in the vicinity of Boston. Before it was completed he received an order from S. C. Chandler for a similar instrument. The performance of this telescope was so satisfactory that Chandler confided to the young optician the construction of his first experimental model of the almucantar[1]. Although this instrument was but cheaply constructed and no attempt was made to give it the finish of a fine piece of apparatus, the results obtained with it were so satisfactory that Chandler had Clacey make the optical parts for the instrument which he used in making the observations from which he detected the variation of latitude.[2] It was at about this time likewise that Chandler gave Clacey an order for the first "chronodeik"[3], a little instrument which had been invented by Chandler for the determination of true local time, and which was used to a considerable extent by watchmakers and others. Clacey made the first dozen of these instruments, and when the order was completed was well started on the line of work which he followed all the rest of his life. At first he carried on all his optical work in a small shop in his own home and contracted with various outside machine shops for the necessary metal parts.

At this time, in the early 80's, amateur astronomy was on a high wave of popularity. Wealthy people in the vicinity of Boston were buying small telescopes and star-gazing parties were the latest fad. Clacey made large numbers of four and five-inch lenses for these enthusiastic amateurs. While working on these smaller telescopes he made an important contribution to the art of lens making by shortening the focal length of refractors. At this time the Clarks would not make a four-inch telescope of less than 60 inches focal length. Clacey gradually reduced this to 40 inches, and a few years ago, succeeded in producing a five-inch lens of 21-inch focus.

Dr. H. L. Smith of Hobart College was advocating the use of shorter

[1] *Proceedings, American Association for the Advancement of Science*, **29**, p. 152; 1880.

[2] *Annals, Harvard College Observatory*, **17**, p. 1; 1887.

[3] *Proceedings, American Association for the Advancement of Science*, **29**, p. 157; 1880. *The Observatory* (London), **4**, p. 14; 1881.

focus telescopes and gave Clacey orders for three or four in succession. Finally, William R. Brooks, the well-known discoverer of comets, asked Clacey whether he could make a 10¼-inch telescope for comet-seeking and photographic purposes with a focal length of 8 or 9 feet. Brooks had already visited the Clarks and they had refused to attempt a telescope with such a short focus. Clacey was looking for just this chance and at once accepted the order and proceeded with the work. In the meantime Brooks had been told by many experienced observers that he would get so much chromatic aberration that the instrument would be useless. He wrote a letter to Clacey asking him if he would not be willing to change the curves to a somewhat longer focus, but Clacey offered to finish the lens with the short focus on his own responsibility, and promised to make any changes which might be necessary afterward at his own expense. In eight weeks he turned over the short focus glass to Brooks and received the following reply: "Color is not only satisfactory but much less than I had made up my mind to accept. It does not interfere with definition in the least."

Prior to the time of which we are speaking, Clacey had found it necessary to move his shop to larger quarters, in Cambridgeport. Here he made numerous lenses, including the 12-inch for Amherst College. About 1895 he received an order from the observatory of Georgetown University, then under the direction of Father Hagen, to make a lens for their new 12-inch equatorial, a 9-inch lens for the photographic transit, and two 6-inch lenses for the collimators to be used with it. In order to carry out this work Clacey came to Washington and commenced the construction of these lenses and also a 9-inch for the Catholic University of America. The Georgetown equatorial presented several difficult problems. The dome in which it was to be installed had been used for many years to house a much smaller telescope, and the focal length of the new instrument was therefore limited to 12 feet. Approximately one year was occupied by Clacey in constructing these lenses, which were entirely successful.

It was while engaged in the work on the Georgetown lenses that Clacey decided to settle in the neighborhood of Washington. He purchased land near Glendale, Maryland, and built his house, where he not only continued to pursue his optical work, but also found the leisure to continue his explorations of the heavens with his own 9-inch telescope. He loves to tell of the "telescope parties," held on the spacious lawn of his Glendale home, for the school children of the village, and of their surprise and amazement at seeing the features of the moon, the rings of Saturn, or the components of a double star. However, it became increasingly apparent that without greater facilities and additional help he would be unable to mount his larger lenses successfully. Since he rightly felt that his special ability should be devoted wholly to lens making, it seemed advisable to look about for an opening which would allow him to pursue this line of work without the necessity of attending to the other details and difficulties of telescope making. While talking

with Mr. Peters of the Naval Observatory, Clacey learned of the possible demand for lenses for the then recently established National Bureau of Standards. He called on Dr. P. G. Nutting, of the optics division, and was offered a position on the Bureau's staff. This presented a difficult question for him to decide. He had always been engaged in independent work and had had no thought of entering the government service. However, he decided to accept the position and give it at least a six-months' trial. As he expresses it, it seemed almost too good to be true to find himself in a laboratory with plenty of equipment and without the bother of a large volume of correspondence and other matters incidental to the conducting of an independent business.

All too often it happens that governmental work degenerates into a mere routine. Fortunately this was not true of work at the Bureau of Standards. Its scientific laboratories were constantly calling for more and more precise optical surfaces of various types and the job of supplying them fell upon Clacey, who devoted the remainder of his active career to keeping up with, or a little ahead of, the demands of the Bureau's physicists. He was fortunate in having in Dr. S. W. Stratton, the then Director of the Bureau, not only a valued friend but an enthusiast in the field of optics, so that every encouragement was furnished for carrying on the finest possible work.

The work of the real artist is seldom associated with mass production, yet during the World War this term might almost be applied to Clacey's activities. For instance, he developed a system for the grinding of optical surfaces of sextant mirrors. These must be truly parallel, and to produce them in quantities was an extremely difficult matter. Clacey conceived the idea of finishing one surface plane and then cementing a large number of the small mirrors with the finished sides down on a large optical flat. By watching the interference fringes between the lower surface of the small mirror and the upper surface of the flat, and by adjustment so as to keep the two surfaces parallel until the cement had set, Clacey was able to produce sextant mirrors with only two or three imperfect ones in a lot of thirty, whereas before only a very small percentage of serviceable ones had been obtained. It was during the war, and with Dr. Stratton's permission, that Clacey accepted the proposition of the Navy Department to overhaul a miscellaneous collection of about 100 optical parts which had been removed from naval instruments as unserviceable. These included parts of range finders, speculum mirrors, prisms, lenses, etc. Many of them were in badly damaged condition yet Clacey was able to return the whole in first class condition in less than two months time. The polishing of the speculum mirrors, in particular, had "stumped" practically everyone to whom the job had been offered, but as Clacey had previously worked on many such surfaces for the Harvard Observatory he experienced no particular difficulty. This work which Clacey did for the Navy Department may be considered as an incentive for starting the Naval Optical Shop. Now, when a vessel comes in for overhauling, the optical parts are sent to the

Optical Shop in the Navy Yard at Washington for refinishing, and are ready for reinstallation when the vessel again goes into commission.

It was during the war that the Bureau of Standards played a leading part in the development of optical glass making. The difficult technique was finally mastered, and ever since 1917 the Bureau has been supplying a large amount of high grade glass to the United States Navy Department. An important accomplishment in connection with this work was the production by Mr. Clacey of a 12-inch astronomical objective from glass made at the Bureau of Standards. He takes great pride in this lens, one of the best samples of his art, as the largest produced from American-made glass. This lens has found important uses in connection with the experimental work of the Bureau's optical instrument section, but its importance lies not so much in its value in the development of methods of testing lenses as in the message which it has carried to everyone who has seen it, that the United States is now independent of foreign sources of supply in the making of high grade optical glass.

Mr. Clacey's last piece of work at the Bureau of Standards was perhaps his most important. In 1926 he succeeded in producing three standards of planeness which are the flatest surfaces in the world. Three disks of clear fused quartz, 10 inches in diameter and from 1½ to 2 inches thick, were ground, polished, and figured by him so that their surfaces do not deviate from a true plane by so much as 1/100 of a light wave length, or one five-millionth of an inch. In the words of Dr. C. A. Skinner[4] who has described the making of these flats, "It is one of those rare accomplishments in which the craftsman has worked with a degree of precision equal to that to which the laboratorian can measure." The importance to the Bureau of the possession of these standards cannot be overestimated since three planes form a self-checking standard, superior to all standards of magnitude, since it does not have to be referred directly or indirectly to any other standard.

This brief sketch of Mr. Clacey's life and work would be incomplete without a statement as to where, outside the Bureau of Standards, his telescopes and lenses are in use. Mention has already been made of the 12-inch of Amherst College, of the 12 and 9-inch lenses of Georgetown University, of the 10¼-inch lens for Brooks at the Smith Observatory, and of the 9-inch for the Catholic University. He also made the 9-inch for the Jesuit College, Aix-la-Chapelle, France, and the 6 and 4-inch lenses of the Vatican Observatory at Rome. For Harvard College Observatory, for the Kirkwood Observatory of Indiana University, for McGill University Observatory, and for St. Joseph's Convent, Manhattanville, N. J., he has made 6-inch lenses, and a 7-inch lens for Boston University Observatory. In addition to these he has made many 3 and 4-inch lenses, mostly for amateurs, but some for such institutions as the United States Naval Observatory, the Coast and Geodetic Survey, the Blue Hills Meteorological Observatory, the Smith Observatory, and the Japanese Navy Department.

[4] *General Electric Review*, Vol. XXIX, No. 8, p. 528; August, 1926.

FORTY-THIRD MEETING OF THE AMERICAN ASTRONOMICAL SOCIETY

[*Continued from page 412.*]

A DETERMINATION OF THE MASSES IN THE BINARY SYSTEMS β 648 AND 99 HERCULIS.

By P. van de Kamp.

The positions of the bright components were measured with respect to 4 and 5 comparison stars, respectively, on photographic plates, obtained with the McCormick 26-inch refractor. For each system the orbital motion was mainly in right ascension during the time interval covered by the plates, and hence only the measures in this coördinate were used for a determination of the mass ratio. Improved proper motions in right ascension of the center of gravity for both binaries have been kindly furnished in advance of publication by the Dudley Observatory. For the present paper the proper motions have been corrected for precession (Introd. P.G.C., page 28). The table below gives the essential data of the present material and the results.

Star		β 648 = β G.C. 8933	99 Herculis = β G.C. 8372
Magnitudes		5.2 - 8.7	5.2 - 9.7
Orbit	Period	57.0 years	56.0 years
	a	1".24	1".03
	Computer	Gushee	Makemson
Parallax		0".075	0".055
Number of Plates		10	13
Interval		May 1919-Aug. 1929	April 1915-Aug. 1929
Mass ratio	A	0.83 ± .07	0.96 ± .09
	B	0.17 ± .07	0.04 ± .09
Total mass		1.39 ⊙	2.09 ⊙
Mass	A	1.15 ⊙	2.01 ⊙
	B	0.24 ⊙	0.08 ⊙
Abs. mag.	A	+4.6	+3.9
	B	+8.1	+8.4

In both cases the brighter star appears to have the larger mass, which is in agreement with previous results on the mass-luminosity relation.

PHOTOGRAPHIC OBSERVATIONS OF ESPIN DOUBLE STARS.

By Alexander Vyssotsky.

Photographs of 72 Espin double stars were secured with the 26-inch telescope and measured at the McCormick Observatory during the years 1924-1927. There are no appreciable systematic differences between Espin and McCormick observations for doubles wider than 2".5; for smaller distances, the stars being mostly faint and the photographs underexposed, the photographic observations are apt to be affected by systematic errors and need further investigation.

THE SPECTRA OF THE INTERNATIONAL CEPHEIDS.

By Margaret L. Walton and Annie J. Cannon.

The spectra of fifty of the sixty-seven variables in the International list of Cepheids have been determined. The others were too faint to be seen on any of the existing photographs at Harvard. Thirty-seven of the variables show a decided change of spectral type with variation in brightness. The results will appear in a forthcoming *Harvard Bulletin*.

THE TOTAL SOLAR ECLIPSE, MAY 9, 1929, OBSERVED IN THE PHILIPPINES.

By R. L. Waterfield.

Slides were shown of photographs of the expedition and of photographs in visual and infra-red light of the corona.

Many of the plans of the expedition were frustrated by the intervention of high cirrus cloud, particularly the attempt to photograph the infra-red flash spectrum and extreme coronal extensions. The flash spectrum showed only four arcs including the X-triplet of calcium, and all the long exposure plates of the corona were badly fogged by the cloud. On the panchromatic plates coronal streamers could be traced to over 5 radii from the limb, despite the cloud, owing to the use of a violet and blue absorbing filter. The photographs in infra-red and visual light gave for the corona identical "contours of equal intensity"; but the infra-red photograph indicates a much more rapid falling-off in the intensity of the infra-red light on passing outwards from the limb, and also appears to show that the outer corona and streamers are practically lacking in these longer rays. Finally, the plate that dealt the best with the cloud situation was the infra-red plate, which was practically the only one that did not "bring up" the cloud. Other members of the expedition were Dr. K. H. Hartline and Mr. W. E. B. Lloyd.

THE CROSSED VERTICAL TRANSIT. A NEW INSTRUMENT OF FUNDAMENTAL ASTRONOMY.

By J. E. Willis.

The earth rotates upon its axis in synchronism with good clocks with an error of perhaps a thousandth of a second per day. This rotation causes stars and other celestial objects to move apparently in circles whose centers lie along the line of the axis of the earth. If two planes at a known angle to each other are attached to the rotating earth, some objects of the heavens will appear to pass through each plane twice each day. If the times of these four passages (two in each of the two planes) for any single object are observed, the complete location of the planes, the object, and the earth's axis with respect to each other can be calculated.

With appropriate mechanical and optical devices these principles can

be utilized to determine the right ascensions and declinations of celestial objects and the longitudes and latitudes of locations on the surface of the earth.

In one proposed system the two planes will be vertical optical planes, one extending from NE to SW, the other extending from NW to SE, each plane being established by the reflection of light through an optical-square system into a horizontal telescope forty feet long. By giving the instruments two uniform motions, the same for the observation of all objects, photography can be applied, if desired. The range of the instrument in this form, if installed at the latitude of Washington (+39°) will be from declination —25°.6 to +56°.6, if observations are made at zenith distances less than 80°.

The outlined system seems to offer the following advantages over the meridian transit circle, upon which practically all positions have heretofore been based:

1. Possibly smaller flexure with the new transit instruments suggested by the problem.
2. Freedom from the uncertainty and labor of the determination of the errors of the divisions of circles. The clock is the only means to be used for the sub-division of the major angles.
3. Freedom from the uncertainty (and labor of computation) of vertical refraction and dispersion. This is of importance because of its bearing on systematic errors.
4. Small parallax corrections—correction necessary for ellipticity but not for sphericity of the earth.
5. More stable instrumental constants if long telescopes are used.

Besides offering the possibility of the improvement of results, the proposed system of observation affords a new and independent method of obtaining results which, when obtained by the older methods, at different observatories or at different times of the day and year, seem to be lacking in consistency.

ASTRONOMICAL DISCOVERIES

By LEAH B. ALLEN.

Some reports of the Trans-Neptunian planet, Pluto, declare its discovery to be the greatest since that of Neptune. What is the criterion of the greatest discovery? Is it that which produces the greatest thrill in the largest number of people? the most surprising one? the one most fundamentally important in solving big cosmical problems?

Notwithstanding the antiquity of astronomy, conspicuous discoveries began with the use of the telescope. Probably Galileo's discovery of Jupiter's satellites was the most amazing. They were the first permanent members of the solar system to be found since the beginning of civilization. The big planet Uranus was a close second in the astonishment it caused. As results of victorious mental efforts in celestial prob-

lems, Kepler's laws and Newton's law of gravitation have been approached only by Einstein's law of gravitation. Halley's discovery of the periodicity of a comet may have had more effect on the happiness of people by destroying superstitious fear of comets than any other astronomical discovery in historical times. But considering only discoveries since that of Neptune in 1846, we find a marvelous list.

The decade beginning with 1860 was noteworthy. In 1862 Alvan G. Clark's observation of the Companion of Sirius confirmed Bessel's announcement made thirty years earlier that the motion of Sirius was affected by an unseen star. Such a star, a pint of which, transferred to the earth, would weigh more than 25 tons! Long as the road is from 1862 to the discovery of the astounding density of that star, we can still appreciate the thrill of that first sight, made possible by a big new telescope. In 1864 Huggins discovered the bright line spectrum of a planetary nebula. He had said of his earliest spectroscopic observations: "I felt as if I had it in my power to lift a veil which had never before been lifted; the veil behind which lay the unknown mystery of the true nature of the heavenly bodies." Of this nebula observation he wrote, "The riddle of the nebula was solved. The answer, which had come to us in the light itself, read: 'Not an aggregation of stars, but a luminous gas!'" In 1866 a connection of meteors with comets was found by Schiaparelli. He discovered the identity of the orbit of the August meteors with that of a comet. This may seem insignificant in comparison with Huggins' discovery, but meteors come much nearer home to us than nebulae!

The satellites of Mars, first seen in 1877, may be of more astronomical interest in themselves than the Martian canals discovered the same year; but the latter resulted in the founding of the Lowell Observatory. Little Eros, discovered in 1898, rivals Uranus in giving man knowledge of the size of the solar system. While Uranus shows the way to more distant members, Eros aids in measuring the scale of the system.

Most discoveries of great importance for further research have not been heralded by the newspapers, although a few have attracted attention. The Zeeman effect in sunspots observed by Hale caused surprise and wonder to astronomers. It has led to new knowledge of the sunspot cycle. The characteristics of spectral lines that reveal absolute magnitude, discerned by Adams and Kohlschütter, have made possible "spectroscopic parallaxes." Thus the number of known distances of stars has been greatly increased.

The relation of mass to luminosity found by Eddington makes it possible to estimate masses of individual stars. Kapteyn's discovery of star streams was remarkable evidence of systematic motions among stars. It has led to Strömberg's discovery of the Great Celestial Way, one direction in which lie the average motions of all groups of celestial objects. Mitchell and Abbot say of this general motion, "No doubt this remarkable procession of the stars and other celestial objects has a profound bearing on the great subject of the evolution of the Universe."

The relation of the period of light change to the luminosity of Cepheid variable stars, discovered by Miss Leavitt, is used to determine the relative distances of stellar systems. Hubble's finding of such Cepheids in spiral nebulae was justly hailed with delight by astronomers, but attracted little public attention. It has led to the discovery of the vast extent of intergalactic space and supergalaxies. Observations confirming Einstein's law of gravitation have certainly aroused and sustained more interest among all classes of people than any other astronomical discovery. No other is known to have caused rioting to obtain entrance to a lecture as happened in New York City when the Einstein film was shown. Probably the discovery of Jupiter's satellites would have had a similar effect if the radio had announced it to the world and moving pictures of the satellites had been shown promptly.

Who can say what is the greatest discovery?

PLANET NOTES FOR NOVEMBER

By CLIFFORD E. SMITH.

The *Sun* will be moving southeast from the western part of Libra to the central part of Scorpio. Its position on the first and last days of the month will be, respectively: R.A. $14^h\ 22^m$, Decl. $-14°\ 8'$; R.A. $16^h\ 21^m$, Decl. $-21°\ 30'$.

The phases of the *Moon* will occur as follows:

Full Moon	Nov. 6	at 4	A.M.	C.S.T.
Last Quarter	13	" 6	A.M.	"
New Moon	20	" 4	A.M.	"
First Quarter	27	" 12	P.M.	"

The moon will be at perigee on November 15 and at apogee on November 27.

Mercury will be moving with an easterly motion from western Libra, across Scorpio, to the southern part of Ophiuchus. Its apparent position will be near that of the sun until the latter part of the month since superior conjunction with the sun occurs on November 7. On November 18 it will be in conjunction with Venus, and also on this date it will pass through its aphelion point. Conjunction with the moon will occur on November 21. During the latter part of the month it will be an evening star of magnitude about minus 1, and on the last day of the month it will set about fifty minutes after the sun. Its distance during the month will vary from about 130 million miles to about 125 million miles.

Venus will be moving with an apparent westerly motion from a point near Antares in Scorpio to central Libra. Early in the month it will be an evening star of magnitude about minus four, setting about two hours after the sun. On the last day of the month, however, it will be a morning star, rising about fifty minutes before the sun, inferior conjunction having occurred on November 22. On November 18 it will be in conjunction with Mercury. Its distance from the earth will decrease from about 31 million miles to about 25 million miles.

Mars will be in central Cancer at the beginning of the month. Its motion will be direct to the western part of Leo. It will be a morning star of brightness about

magnitude zero. During the middle of the month it will be on the meridian about 5:00 A.M., and its distance from the earth will be about 97 million miles. It will be in conjunction with the moon on November 12.

Jupiter will be a morning star in eastern Gemini of brightness about magnitude minus two. Its motion will be easterly until November 8, when it will reach a stationary point; the remainder of the month its apparent motion will be westerly. Conjunction with the moon will occur on November 11. During the middle of the month Jupiter will be on the meridian about 4:00 A.M., and its distance will be about 430 million miles.

Saturn will be an evening star of magnitude about plus one in western Sagittarius. Its motion in the sky will be easterly, and conjunction with the moon will occur on November 23. During the middle of the month it will set about three hours after the sun, and its distance from the earth will be about a billion miles.

Uranus will be in central Pisces, and its motion will be retrograde. During the middle of the month it will be on the meridian about 9:00 P.M. and its distance from the earth will be about 1800 million miles. It will be in conjunction with the moon on November 3.

Neptune will be in central Leo and during the latter part of the month it will rise about midnight since quadrature west of the sun occurs on November 28. Its apparent motion during this period will be direct, and its approximate distance during the middle of the month will be about 2800 million miles. Conjunction with the moon will occur on November 14.

Occultations Visible at Washington

[From the *American Ephemeris.*]

Date 1930	Star	Mag.	IMMERSION Washington C.T. h m	IMMERSION *a* m	IMMERSION *b* m	IMMERSION Angle E from N °	EMERSION Washington C.T. h m	EMERSION *a* m	EMERSION *b* m	EMERSION Angle E from N °
Nov. 2	4 Cet	6.3	16 53	—0.9	+1.5	95	17 47	—0.5	+2.6	197
2	5 Cet	6.3	17 12	—1.1	+1.6	88	18 12	—0.6	+2.5	201
3	155 B.Psc	6.5	16 59	—0.4	+1.8	76	18 1	—0.5	+2.2	217
6	63 Ari	5.2	21 25	—0.8	+2.1	51	22 38	—1.4	+1.5	245
6	65 Ari	6.0	22 19	—1.9	+1.1	86	23 29	—1.0	+2.5	212
10	49 Aur	5.1	4 51	—1.8	—0.6	88	6 6	—1.1	—1.8	290
11	ν Gem	4.3	3 31	—2.3	+2.1	61	4 32	—1.5	—3.0	325
11	28 Cnc	6.1	23 10	0.0	+1.4	82	0 8	—0.6	+0.5	292
12	ν^1 Cnc	5.7	0 25	—0.5	+1.7	78	1 28	—1.2	0.0	301
12	ν^2 Cnc	6.4	1 10	—0.7	+2.5	64	2 6	—1.6	—1.1	319
26	κ Cap	4.8	20 41	—0.1	+0.9	25	21 39	—0.9	—1.5	269

The quantities in the columns *a* and *b* are given for the purpose of making these predictions useful for any place within 200 or 300 miles of Washington. The procedure is as follows: Subtract the longitude of Washington (77°.1) from the longitude of the place in question; multiply the result, taking the signs into account, by the quantity under *a* for the star to be observed; similarly, with the latitude (38°.9) using *b*; apply the sum of the products, with its proper sign, to the Washington C.T., and obtain the predicted Washington Civil Time for the phenomenon at the place of observation. To obtain Eastern Standard Time it is necessary to add 8.3 minutes to Washington Civil Time.

COMET NOTES

By G. VAN BIESBROECK.

The various comets that were observable in the early part of the year have now become invisible for stations north of the equator, except BEYER's (1930 *b*) which requires, however, a large instrument to be reached. The ephemeris given on p. 440 follows the measures closely. Its continuation (*Lick Obs. Bulletin* 423) shows that while the brightness is slowly decreasing, the position in the evening sky will remain favorable for the balance of the year. During that time the comet passes from Corona Borealis into Hercules. Conjunction with the sun occurs on December 7; after that date the comet is better placed in the morning sky. On September 17 the writer estimated the total brightness as 13M. There was a sharp nucleus surrounded by an elliptic coma some 50″ in diameter, extending mostly toward the northeast, so that the nucleus appeared eccentrically placed in the coma.

EPHEMERIS OF COMET BEYER.

1930	α h m s	δ ° ′	Δ	*r*	M
Sept. 25	14 12 35	+46 16	3.24	2.78	13.0
Oct. 3	14 34 2	44 30			
11	14 54 27	42 45			
19	15 13 52	41 4			
27	15 32 22	39 28			
Nov. 4	15 49 59	37 58	3.53	3.09	13.4
12	16 6 46	36 36			
20	16 22 46	35 22			
28	16 38 0	34 18			
Dec. 6	16 52 30	33 23			
14	17 6 15	32 38	3.87	3.41	13.8
22	17 19 18	32 4			
30	17 31 37	+31 39	3.99	3.54	14.0

The distance from the sun being considerable the predicted decrease in brightness will probably remain nearly correct so that a long period of observation is to be anticipated, at least for large instruments.

In this respect STEARN'S COMET (1927 IV) is quite remarkable. Its faint trace was still visible on plates exposed August 24 by Baade in Bergedorf and September 17-18 by the writer at Williams Bay, three and a half years after it was discovered! The plates show it as a tiny round nebulosity, the brightness of which corresponds to that of a 17M star. The deviation from the ephemeris (see p. 120) is small in position as well as in brightness, so that further extension of the period of observation is to be expected. The distance of the comet from the sun is now just beyond that of the planet Saturn.

COMETS 1930 *c* (WILK) and 1930 *e* (FORBES) are now too faint for further observations. But COMET 1930 *d* (SCHWASSMANN-WACHMANN) is still a fairly easy object for southern observers. On August 4 H. E. Wood called the magnitude 10 from plates taken at the Johannesburg Observatory.

It seems now as though both periodic comets D'ARREST and TEMPEL II will remain unobserved at their present return. The former passed nearest to the Sun last May but was then unfavorably situated. It is now better placed but evidently quite faint. The latter comet, coming to perihelion on October 5, ought to be brighter; however, the computed place is in Scorpius which sets very shortly

after the Sun at present so that the only chance to see the comet would be near the horizon.

Williams Bay, Wisconsin, September 19, 1930.

POSTSCRIPT.

COMET TEMPEL II RECOVERED. Last night the writer secured a double exposure on the field of Periodic Comet Tempel II. The sky was fine and in spite of the low altitude of the object the comet was readily located on the plates, which were exposed for 12 minutes each with the 24-inch reflector.

The position came out as follows:

Sept. 22.05468 U.T. $16^h\ 35^m\ 53^s.56$ $-20°\ 57'\ 15''.4$ (1930)

The comet showed a well-defined nucleus and a fan-shaped tail on the north preceding side. The total magnitude was estimated as 12th. The comet is located exactly in the ephemeris position given in the *Handbook of the British Astronomical Association* for 1930, thus showing that the predicted time of perihelion passage, 1930 October 5, is correct. The period is 5.16 years. The comet was well observed at its previous return in 1925. It is now moving southward and is very difficult to reach for stations north of the equator, but it is in easy reach of Southern Observatories where very likely it will be followed for some time. The path during October is shown by this ephemeris:

	α	δ
	h m	° ′
Sept. 28	16 55.7	−22 43
Oct. 6	17 24.6	−24 48
14	17 55.2	−26 28
22	18 27.2	−27 39
Oct. 30	19 00.0	−28 19

Williams Bay, Wisconsin, September 22, 1930.

VARIABLE STARS

Monthly Report of the American Association of Variable Star Observers for July and August, 1930.

Another double report is presented herewith, with nearly 4300 observations on 416 variables by 41 different observers. Nearly 70 per cent of the total number were made by nine observers, but this fact in no way lessens the value of the other 30 per cent made by the remaining 32 observers. One never knows how valuable may be even a solitary observation by one lone observer, especially when it happens to be one revealing the sudden increase or decrease in the light of one of the erratic, irregular variables, of which we have several on our observing list.

This is well illustrated in the case of the few observations secured by Sig. Lacchini on the variable SU Tauri, which he found faint after it had emerged from the sun's rays late in July. Every effort should be made to secure frequent observations of this variable which has remained at normal maximum brightness for less than a year. RY Sagittarii also demands close attention, especially by the southern observers. This variable has remained fainter than the 13th magnitude for some months past, and its rise to maximum should be carefully observed.

We welcome observations from the following recent contributors, some of

VARIABLE STAR OBSERVATIONS RECEIVED DURING JULY AND AUGUST, 1930.

June 0 = J.D. 2426128; July 0 = J.D. 2426158; August 0 = J.D. 2426189.

J.D.Est.Obs.

V Scl
000339
160 10.4 Dr
S Scl
001032
099 13.0 Dr
147 11.6 Ht
160 10.5 Dr
X And
001046
130 9.2 Lj
133 9.1 Lj
142 9.3 Lj
145 9.8 Lj
147 9.8 Lj
157 10.1 Lj
158 10.2 Lj
161 10.1 Lj
176 10.6 Lj
177 10.7 Lj
183 11.0 Lj
184 10.9 Lj
188 11.1 Lj
191 10.5 Br
T Cet
001620
151 6.7 L
158 6.5 L
162 6.7 L
180 6.7 L
180 6.6 Tf
187 6.4 Tf
T And
001726
121 9.0 Ch
148 11.4 Jo
152 10.5 Pt
153 11.0 Jo
166 11.8 Jo
180 12.5 Pt
191 12.9 Br
T Cas
001755
121 12.0 Ch
135 11.3 L
144 11.5 Bc
147 11.4 Fd
149 11.2 Fd
152 11.1 Pt
152 10.3 L
153 10.7 Bc
155 10.8 Fd
156 11.2 Fd
156 10.0 Bc
160 9.9 Bc
164 9.8 L
166 10.4 Jo
172 9.8 Jo
174 9.9 Jo

T Cas
001755
176 9.3 L
180 10.0 Pt
180 9.9 Jo
183 9.8 Jo
R And
001838
191[14.2 Br
S Tuc
001862
147[13.5 Ht
160[13.5 Dr
S Cet
001909
135[11.5 L
153[13.5 L
180 14.1 L
T Scl
002438a
099 13.1 Dr
160 10.8 Dr
RR Scl
002438b
160 12.9 Dr
T Phe
002546
099 11.9 Dr
147 10.4 Ht
160 10.7 Dr
W Scl
002833
160 13.3 Dr
Y Cep
003179
135 10.6 L
148 10.0 Sf
152 9.7 L
153 10.0 Sf
162 9.8 Sf
164 9.4 L
170 10.0 Sf
175 10.1 L
191 10.4 Br
U Cas
004047
135 10.9 L
152 12.1 L
152 12.0 Pt
164 12.7 L
181 13.3 L
191 14.1 Br
RW And
004132
152[13.7 L
180 14.2 L
191[13.9 Br

V And
004435
191 12.7 Br
RR And
004533
191[14.2 Br
RV Cas
004746a
191 14.7 Br
— Cas
004746b
152 10.5 Pt
180 10.6 Pt
W Cas
004958
144 12.0 Jo
152 11.1 Pt
153 11.9 Jo
155 12.0 Fd
156 12.0 Jo
160 12.0 Jo
166 12.0 Jo
172 12.0 Jo
174 11.9 Jo
180 11.9 Jo
180 11.8 Pt
183 12.0 Jo
188 11.5 BL
190 11.6 BL
191 11.8 BL
193 11.5 Fd
U Tuc
005475
100 12.2 Ht
117 10.8 Dr
144 9.5 Bl
147 9.1 Ht
153 8.6 Dr
154 9.0 Bl
Z Cet
010102
135 8.6 L
153 9.2 L
164 10.2 L
176 11.1 L
180 11.1 Pt
U Scl
010630
160 12.5 Dr
U And
010940
139[13.0 L
154[13.8 L
180 13.8 L
UZ And
011041
183[12.5 Ma
191 13.0 Br

S Psc
011208
139 9.4 L
152 9.6 L
166 10.1 L
181 10.3 L
192 11.0 Br
S Cas
011272
144 9.0 Jo
148 9.5 Jo
153 9.6 Jo
155 9.4 Pt
170 9.0 Jo
174 9.6 Jo
180 9.6 Jo
180 9.5 Pt
183 9.7 Jo
191 10.2 Br
U Psc
011712
138[12.3 L
152 14.1 L
166 14.1 L
181 13.9 L
191 13.0 Br
R Scl
012233a
160 7.0 Dr
RZ Per
012350
139 12.7 L
154 13.6 L
166 13.5 L
182 13.5 L
191 13.0 Br
RU And
013238
138 10.1 L
152 10.7 L
155 10.7 Pt
166 10.9 L
180 11.5 Pt
182 11.4 L
Y And
013338
138 11.2 L
152 12.3 L
155 12.4 Pt
180 14.4 Pt
182 13.9 L
X Cas
014958
149 10.2 Fd
155 11.0 Pt
156 11.0 Bn
177 10.7 Bn
180 10.0 Pt
205 10.7 Bn

U Per
015254
149 11.3 Fd
155 11.0 Fd
155 10.0 Pt
156 11.0 Fd
180 10.8 Pt
S Ari
015912
140 12.6 L
154 11.6 L
169 11.2 L
180 10.5 Pt
182 11.3 L
192 11.0 Br
R Ari
021024
140 8.1 L
154 7.7 L
155 7.5 Fd
155 8.0 Pt
156 7.5 Fd
169 7.8 L
180 8.4 Pt
182 8.2 L
193 9.7 Fd
W And
021143a
155 7.8 Pt
180 9.0 Pt
181 9.1 Gy
T Per
021258
135 8.7 Ah
144 8.6 Ah
149 8.7 Fd
155 8.6 Fd
155 8.7 Ah
155 9.0 Pt
156 8.4 Fd
180 8.6 Pt
180 9.0 Jo
183 8.7 Jo
193 9.1 Fd
Z Cep
021281
173 13.8 L
o Cet
021403
146 3.3 L
151 3.3 L
155 3.6 L
158 3.4 L
160 3.6 L
162 3.6 L
173 3.6 L
175 5.3 Jo
180 5.0 Jo
180 3.8 Pt

o Cet
021403
181 3.9 Gy
182 3.8 L
183 4.7 Jo
187 3.7 Tf
191 4.2 Gy
S Per
021558
135 9.3 Ah
144 9.3 Ah
149 9.0 Fd
155 9.2 Ah
155 9.4 Pt
155 9.2 Fd
156 9.3 Fd
180 9.1 Pt
180 8.5 Jo
183 8.5 Jo
193 9.2 Fd
R Cet
022000
153 10.1 L
173 8.1 L
RR Per
022150
140 12.1 L
154 11.6 L
173 11.8 L
R Tri
023133
149 11.8 Fd
155 11.3 Pt
172 9.7 Tf
180 9.2 Pt
180 9.5 Jo
181 9.3 Gy
183 9.4 Jo
187 8.6 Tf
W Per
024356
155 10.8 Pt
180 9.8 Pt
181 10.0 Jo
183 10.3 Jo
R Hor
025050
099 6.1 Ht
099 6.0 Dr
160 8.2 Dr
T Hor
025751
099 8.1 Ht
099 8.0 Dr
117 8.0 Dr
160 11.5 Dr
U Ari
030514
158 9.2 L

VARIABLE STAR OBSERVATIONS RECEIVED DURING JULY AND AUGUST, 1930.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
U ARI	R RET	S PIC	RU AUR	V AUR	Z PUP
030514	*043263*	*050848*	053537	061647	*073820b*
173 9.2 L	117 8.7 Sm	099 12.9 Ht	180 9.6 Pt	183 8.8 L	102[12.1 En
185 9.9 L	117 8.6 Dr	099 13.0 Dr	SU TAU	AG AUR	122[12.1 En
X CET	123 9.7 En	113[12.2 En	054319	062047	S VOL
031401	125 9.0 Sm	117 13.6 Dr	181[11.6 L	139 9.3 L	*073173*
161 9.8 L	131 9.6 Ht	125[12.2 Sm	184[12.1 L	172 9.4 L	099 10.1 Ht
176 11.0 L	142 9.5 Dr	144[12.9 Bl	S COL	183 9.5 L	102 10.2 En
193 11.5 Fd	144 9.7 Bl	160[13.6 Dr	*054331*	NOV PIC	113 9.5 En
Y PER	153 10.0 Dr	R AUR	NOV PIC	*063462*	113 9.5 Ht
032043	154 10.3 Bl	050953	*063462*	099 8.3 Ht	117 9.1 Dr
155 10.6 Pt	X CAM	159 9.5 Ah	099[12.6 Ht	102 8.3 En	121 9.5 Sm
180 10.5 Pt	043274	160 9.5 Ah	113[12.6 Ht	113 8.3 En	121 9.5 En
R PER	138 9.2 L	180 7.8 Pt	125[12.2 Sm	113 8.2 Ht	127 8.9 Dr
032335	146 10.1 L	T PIC	R COL	121 8.4 Sm	131 8.7 Ht
158 12.9 L	155 11.2 Pt	*051247*	*054620*	121 8.1 En	131 8.9 Sm
176 12.3 L	156 10.8 L	099 11.4 Ht	099[13.0 Ht	131 8.2 Ht	141 9.3 En
180 12.2 Pt	165 12.0 L	099 11.1 Dr	113[13.0 Ht	131 8.4 Sm	142 9.0 Dr
T FOR	176 12.3 L	113 11.8 En	125[12.4 Sm	141 8.1 En	142 9.2 Ht
032528	180 12.0 Pt	113 11.8 Ht	V CAM	142 8.2 Ht	144 8.9 Bl
183 9.4 L	R DOR	117 12.5 Sm	054974	149 8.2 Ht	149 9.5 Ht
U ERI	*043562*	117 12.4 Dr	139 10.0 L	149 8.4 Sm	149 8.9 Sm
034625	099 5.3 Ht	160 12.8 Dr	150 10.9 L	154 8.3 En	151 9.2 Dr
099 9.9 Dr	099 5.7 Dr	T COL	155 11.0 Pt	157 8.3 En	154 9.1 Bl
160 10.2 Dr	113 5.5 Ht	*051533*	172 11.3 L	S LYN	154 9.3 En
T ERI	113 5.8 En	099 8.6 Ht	180 11.2 Pt	063558	S GEM
035124	117 5.9 Dr	099 8.6 Dr	184 11.5 L	140 13.7 L	073723
099 11.7 Dr	117 5.8 Sm	102 8.3 En	Z AUR	177 13.6 L	114 13.0 Ch
160 7.6 Dr	123 6.0 En	113 8.1 Ht	055353	X MON	W PUP
W ERI	125 5.8 Sm	113 7.9 En	161 10.0 Pt	*065208*	*074241*
040725	132 5.5 Ht	117 8.1 Sm	180 10.6 Pt	099 7.4 Dr	099 11.9 Ht
099 11.1 Ht	144 5.5 Bl	117 7.8 Dr	188 10.6 Pt	117 7.5 Dr	099 11.3 Dr
117 12.0 Ht	154 5.5 Bl	123 7.9 En	R OCT	127 7.6 Dr	102 11.9 En
160 12.5 Ht	R CAE	127 7.7 Dr	*055686*	142 8.1 Dr	113 11.9 Ht
W TAU	*043738*	142 7.3 Dr	099 11.2 Dr	151 8.5 Dr	113 12.3 En
042215	099[12.0 Ht	160 7.7 Dr	100 11.4 Ht	153 10.3 Dr	117 11.9 Dr
167 10.1 L	113[12.0 Ht	S AUR	102 11.0 En	R LYN	121 11.9 Sm
T CAM	117 12.0 Dr	052034	113 10.6 En	065355	121 11.4 En
043065	160 10.4 Dr	180 8.6 Pt	113 11.1 Ht	140 11.2 L	127 10.4 Dr
146 8.7 L	R PIC	W AUR	117 10.9 Dr	151 11.0 L	130 10.7 En
155 8.8 Pt	*044349*	052036	121 10.5 En	163 9.9 L	131 11.6 Ht
156 8.6 L	099 7.2 Ht	176 9.7 L	121 10.9 Sm	177 9.7 L	131 10.1 Sm
157 8.7 Wk	099 6.8 Dr	180 9.8 Pt	131 10.6 Ht	R VOL	142 9.4 Dr
165 8.5 L	102 6.5 En	S CAM	131 10.3 Sm	*070772*	142 9.4 Ht
180 8.8 Pt	113 6.8 Ht	053068	141 9.6 En	099 12.8 Ht	144 9.1 Bl
181 8.6 L	114 6.0 En	155 10.0 Pt	144 9.8 Bl	113 13.4 Ht	145 9.1 Dr
187 8.8 Jo	117 7.0 Sm	180 10.4 Pt	145 9.5 Dr	113 13.2 En	149 9.2 Ht
RX TAU	117 6.6 Dr	187 9.5 Jo	147 9.9 Ht	117 12.4 Dr	149 9.4 Sm
043208	125 7.0 Sm	RR TAU	149 9.4 Sm	121 13.4 En	151 9.0 Dr
184 11.6 L	127 6.5 Dr	053326	154 9.1 Bl	142 13.3 Dr	154 8.8 Bl
R RET	144 6.7 Bl	177 10.7 L	X AUR	149[13.4 Ht	154 8.9 En
043263	154 7.7 Bl	179 10.8 L	060450	L_2 PUP	T GEM
099 8.1 Ht	160 7.3 Dr	180 10.6 L	101 9.4 Ch	*071044*	074323
099 8.2 Dr	S PIC	181 10.9 L	163 12.5 L	117 4.0 Dr	114 11.8 Ch
113 8.5 Ht	*050848*	182 10.9 L	177 11.6 L	127 4.4 Dr	R CNC
113 8.7 En	099 12.9 Ht	183 11.4 L	180 11.0 Pt	142 4.9 Dr	081112
	099 13.0 Ht	184 12.2 L	183 11.3 Lj	145 4.9 Dr	125 7.8 Ch
	113[12.2 En	U AUR	189 10.4 Lj	151 5.3 Dr	134 7.9 Ch
	117 13.6 Ht	053531	V AUR		
	125[12.2 Sm	177[11.0 L	061647		
			140 8.7 L		
			172 8.7 L		

VARIABLE STAR OBSERVATIONS RECEIVED DURING JULY AND AUGUST, 1930.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
V CNC	RW CAR	R LMI	Z VEL	Z CAR	V HYA
081617	*091868*	093934	*094953*	*101058a*	*104620*
124 9.2 Ch	113 11.7 En	119 7.6 Ch	113[12.8 Ht	114[12.3 En	154 7.0 Bl
141 10.8 L	117 11.5 Dr	132 7.3 Ah	121[12.1 Sm	125[12.3 Sm	154 6.5 L
R CHA	121 10.7 En	133 7.3 Ah	131[12.1 Sm	144[12.6 Bl	156 6.8 Ch
082476	130 9.8 En	134 7.3 Ah	144 13.4 Bl	149[12.6 Ht	RS HYA
099 12.4 Ht	131 9.8 Ht	135 7.3 Ah	149[12.8 Ht	157[12.3 Sm	*104628*
113 12.6 Ht	141 9.7 En	140 7.9 Gy	154 13.0 Bl	AF CAR	115 12.0 En
121[12.6 Sm	142 9.7 Dr	141 7.4 Pt	V LEO	*101058b*	122 12.2 En
144[12.6 Bl	142 9.7 Ht	144 7.3 Ah	095421	099 14.6 Dr	130 12.5 En
149[12.6 Ht	144 9.6 Bl	144 7.2 Fd	115 13.1 Ch	W VEL	143 13.0 En
157[12.4 Sm	149 9.5 Ht	145 7.4 Ch	152 13.5 Ch	*101153*	144 13.2 Bl
U CNC	150 9.7 En	145 7.5 Ah	RR CAR	099 9.3 Ht	154 13.3 Bl
083019	151 9.7 Dr	146 7.5 Ah	*095458*	113 9.8 Ht	W LEO
124[12.4 Ch	154 9.5 Bl	147 7.4 Ah	099 8.3 Ht	114 9.5 En	104814
141[11.9 L	154 9.6 En	147 7.5 HS	113 8.3 Ht	117 9.3 Dr	124 13.2 Ch
S HYA	Y VEL	147 7.3 Fd	114 8.0 En	121 9.8 Sm	141 12.0 Pt
084803	*092551*	148 7.4 HS	121 7.8 En	121 9.8 En	141 12.3 L
124 11.6 Ch	099 14.3 Dr	148 7.1 Fd	130 7.6 En	130 10.0 En	152 11.8 Ch
134[11.1 Ch	113[12.9 Ht	150 7.3 HS	131 8.0 Ht	131 10.2 Sm	153 11.5 L
T HYA	114[12.4 En	155 7.2 Fd	142 7.9 Ht	131 10.2 Ht	155 10.9 Ma
085008	121[12.4 En	157 7.4 HS	143 8.0 En	141 10.2 En	163 10.8 L
124 8.4 Ch	131[12.1 Sm	RR HYA	149 8.0 Ht	142 10.5 Ht	172 10.1 L
T CNC	144 13.3 Bl	*094023*	150 8.1 En	142 9.7 Dr	RS CAR
085120	154 13.2 Bl	114 10.2 En	RV CAR	144 9.8 Bl	*110361*
124 8.2 Ch	157[12.1 Sm	117 9.6 Dr	*095563*	149 10.7 Sm	121[12.3 Sm
148 8.5 BL	R CAR	121 9.8 En	099 11.5 Ht	149 10.8 Ht	131[12.3 Sm
151 8.8 BL	*092062*	130 9.5 En	113 11.8 Ht	150 10.7 En	157 12.3 Sm
155 8.5 BL	099 9.7 Ht	142 9.2 En	114 11.8 En	151 9.7 Dr	S LEO
T PYX	113 9.7 Ht	142 8.4 Dr	117 12.0 Dr	154 10.4 Bl	110506
090031	114 9.9 En	150 9.0 En	121 11.8 En	157 10.8 Sm	124 10.1 Ch
144 [t Bl	117 9.3 Dr	151 8.7 Dr	130 12.1 En	U HYA	138 9.9 L
154 [t Bl	121 9.7 En	R LEO	144 12.8 Bl	*103212*	141 10.0 Pt
V UMA	121 10.0 Sm	094211	149 13.1 Ht	124 5.7 Ch	146 10.0 L
090151	127 9.3 Dr	097 8.2 Ch	151 13.5 Dr	141 5.3 L	152 10.0 Ch
138 10.2 L	130 9.6 En	115 6.4 Ch	S CAR	RZ CAR	153 10.5 L
143 10.7 Sf	131 10.0 Sm	124 6.0 Ch	*100661*	*103270*	155 10.1 Ma
146 10.5 L	131 9.7 Ht	132 5.4 Ah	099 5.8 Ht	099[15.2 Dr	163 10.5 L
155 10.5 L	141 9.6 En	141 5.5 Pt	099 5.5 Dr	113[13.1 Ht	172 11.2 L
163 10.6 L	142 9.2 Dr	144 5.7 Fd	113 5.5 Ht	121[13.1 En	RY CAR
174 10.4 L	142 9.4 Ht	147 5.7 HS	114 5.8 En	142[13.1 Ht	*111561*
W CNC	144 9.1 Bl	148 5.7 HS	117 5.4 Dr	149[13.1 Ht	113 13.3 Ht
090425	149 9.4 Sm	148 5.5 BL	121 6.0 Sm	R UMA	117 12.8 Dr
124 9.2 Ch	149 9.3 Ht	150 5.7 HS	121 5.8 En	103769	121 12.1 En
138 8.3 L	150 9.2 En	151 5.4 BL	127 5.6 Dr	114 12.8 Ch	125 12.1 Sm
146 8.3 L	151 9.0 Dr	152 5.8 Ch	130 6.0 En	141 12.6 Pt	127 11.5 Dr
155 8.2 L	154 8.9 Bl	155 5.6 BL	131 5.5 Ht	153 13.1 Ch	130 11.0 En
163 8.3 L	157 9.2 Sm	155 6.0 Ma	131 5.8 Sm	172 12.5 Pt	131 11.0 Sm
RX UMA	X HYA	157 5.8 HS	141 6.2 En	V HYA	131 12.1 Ht
090567	*093014*	165 6.0 BL	142 6.2 Ht	*104620*	141 10.6 En
138 11.2 L	099 9.7 Ch	Y HYA	142 6.1 Dr	099 6.8 Ch	142 10.8 Ht
146 11.0 L	Y DRA	*094622*	144 6.2 Bl	108 6.6 Ch	142 10.2 Dr
155 10.8 L	093178	114 8.2 En	145 6.3 Dr	114 6.9 En	144 10.6 Bl
163 11.1 L	140[13.9 L	121 8.1 En	149 6.4 Ht	121 7.1 En	145 10.2 Dr
174 11.0 L	151[13.9 L	130 8.1 En	149 6.5 Sm	130 7.1 En	149 10.5 Ht
RW CAR	173 13.9 L	142 8.2 En	150 6.3 En	141 6.8 L	149 10.6 Sm
091868	R LMI	150 8.2 En	151 6.6 Dr	143 7.5 En	150 10.6 En
099 12.2 Ht	093934	Z VEL	154 6.9 Bl	144 6.5 Bl	151 10.0 Dr
099 12.1 Dr	097 9.3 Ch	*094953*	157 7.5 Sm	150 7.1 En	153 10.2 Dr
113 11.1 Ht	116 7.5 Gy	099 14.5 Dr			154 10.7 En

VARIABLE STAR OBSERVATIONS RECEIVED DURING JULY AND AUGUST, 1930.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
RY CAR	R COM	U CEN	T UMA	S UMA	U VIR
111561	115919	*122854*	123160	123961	124606
154 10.5 Bl	152 10.5 Ch	099 8.7 Ht	165 8.7 Ma	142 10.0 Fd	132 8.4 Ah
157 10.8 Sm	155 10.6 BL	099 8.7 Dr	165 8.5 Bc	143 9.4 Wd	135 8.4 Ah
157 10.8 En	165 10.9 BL	113 9.6 Ht	165 8.5 Fd	144 9.6 Jo	141 8.2 L
RS CEN	172 11.1 BL	115 9.8 En	166 8.8 Wd	144 9.6 Lj	144 8.4 Ah
111661	172 11.6 Pt	117 9.6 Dr	166 8.5 Jo	144 9.2 Ah	144 7.8 Fd
099 13.7 Dr	176 11.4 BL	122 10.2 En	170 8.9 Wd	144 10.2 Fd	145 8.4 Ah
117 13.6 Dr	SU VIR	122 10.1 Ht	170 8.7 HS	145 9.5 Ah	146 8.5 Ah
127 13.2 Dr	120012	127 10.3 Dr	170 8.5 Jo	146 9.8 Lj	147 8.5 Ah
130 13.3 En	124 12.8 Ch	130 10.4 En	172 8.6 Ma	146 9.5 Ah	153 8.2 L
141 12.1 En	155[12.5 Ma	143 11.1 En	172 8.9 Wd	147 9.6 Ah	157 8.2 Ch
142 12.7 Ht	166[12.4 Bw	144 11.5 Bl	172 8.9 Pt	147 10.0 Fd	165 8.2 L
142 12.2 Dr	173[12.4 Mg	145 11.3 Dr	174 8.7 Jo	148 10.0 Fd	172 8.6 Pt
144 11.9 Bl	T VIR	147 12.0 Ht	180 9.0 Jo	148 9.5 Be	173 9.0 Mg
149 10.5 Ht	*120905*	150 11.7 En	183 9.5 Jo	148 9.5 Wd	175 8.8 L
149 10.8 Sm	141[13.8 L	151 11.5 Dr	188 9.8 Wd	149 10.3 Fd	RV VIR
150 10.7 En	157[13.2 Ch	154 12.1 Bl	188 9.6 Ma	150 9.5 Ma	*130212*
151 10.4 Dr	R CRV	T UMA	193 10.0 Bc	150 9.7 Wd	169 14.0 L
153 10.1 Dr	*121418*	123160	193 10.1 Fd	153 10.0 Jo	180 13.8 L
154 10.0 Bl	141 12.3 Pt	099 9.5 Ch	R VIR	153 10.5 Fd	U OCT
154 10.3 En	141 12.4 L	132 8.2 Ah	123307	155 10.5 Fd	*131283*
157 9.8 En	153 12.7 L	133 8.0 Ah	111 6.9 Ch	155 10.2 Ah	099 9.2 Dr
157 10.3 Sm	180 11.7 L	133 8.0 Ch	132 7.0 Ah	156 10.4 Fd	100 9.3 Ht
X CEN	SS VIR	134 8.0 Ah	135 7.1 Ah	156 9.9 Jo	114 8.6 Ht
114441	122001	135 8.1 Ah	139 7.2 Ah	157 10.4 Lj	115 8.5 En
144 13.5 Bl	138 7.2 L	138 8.2 Ah	141 7.2 Pt	157 10.7 Wk	117 8.4 Dr
153 13.3 Dr	146 7.1 L	139 8.2 Ah	144 7.9 Fd	158 10.2 Ah	121 8.0 Sm
154 13.0 Bl	153 7.1 L	141 8.1 Pt	144 7.8 Ah	159 10.4 Ah	126 8.3 En
AD CEN	165 7.1 L	142 8.2 Ah	145 7.7 Ah	160 10.4 Ah	127 8.3 Dr
114858	175 7.1 L	142 8.2 Fd	146 8.0 Ah	160 9.7 Jo	131 8.1 Ht
099 9.1 Ht	T CVN	143 8.0 Wd	147 8.0 Ah	160 10.3 Fd	131 8.5 Sm
113 9.7 Ht	122532	144 8.3 Jo	147 7.6 Fd	161 10.4 Lj	131 8.2 En
121 9.1 Sm	124 11.3 Ch	144 8.3 Ah	151 9.0 Mc	165 10.7 Ma	143 8.5 En
131 9.5 Ht	141 10.9 Pt	144 8.5 Fd	154 8.9 Ch	165 10.4 Bc	144 8.5 Bl
142 9.5 Ht	144 11.4 Fd	145 8.3 Ah	155 8.6 Fd	165 10.3 Fd	145 8.5 Dr
149 9.3 Ht	148 10.9 Fd	146 8.3 Ah	158 11.4 Mc	166 10.5 Jo	147 8.5 Ht
156 9.5 Sm	148 11.1 BL	147 8.3 Ah	172 11.2 Pt	170 10.5 Jo	149 8.5 Sm
W CEN	151 10.8 BL	147 8.3 HS	RS UMA	172 11.2 Ma	151 8.5 Dr
115058	155 11.0 BL	147 8.1 Fd	123459	172 11.1 Lj	154 8.5 Bl
099 10.7 Ht	156 10.6 Ch	148 8.5 Fd	111 11.8 Ch	172 10.9 Pt	V CVN
113 11.4 Ht	156 11.0 Fd	148 8.2 Wd	141 13.4 Pt	172 10.4 Wd	131546
115 11.7 En	165 10.5 BL	149 8.5 Fd	172 14.3 Pt	174 10.7 Jo	193 8.2 Gb
117 11.1 Dr	172 10.6 BL	150 8.1 Ma	S UMA	176 11.3 Lj	W VIR
121 12.2 Sm	172 10.6 Pt	150 8.3 Wd	123961	177 11.3 Lj	*132002*
122 12.2 En	176 10.5 BL	150 8.4 HS	099 8.2 Ch	180 11.7 Jo	173 10.3 Mg
127 12.1 Dr	179 10.5 BL	153 8.3 Jo	111 8.4 Ch	183 11.7 Jo	V VIR
130 12.2 En	Y VIR	153 8.4 Fd	119 8.5 Ch	184 11.4 Lj	*132202*
142 12.6 Ht	*122803*	155 8.2 Fd	130 9.1 Lj	188 11.6 Lj	172 13.6 L
144 12.4 Bl	124 10.7 Ch	155 8.5 Ah	132 9.2 Lj	RU VIR	184 13.2 L
145 12.8 Dr	138 9.7 L	156 8.2 Jo	132 8.7 Ah	124204	R HYA
151 13.0 Dr	146 9.5 L	157 8.6 HS	133 9.0 Ah	141 12.5 Pt	*132422*
154 13.1 Bl	153 9.5 L	157 8.0 Wk	133 8.9 Ch	141 12.0 L	100 9.2 Ht
156 12.6 Sm	156 9.8 Ch	158 8.5 Ah	134 8.8 Ah	153 12.6 L	111 9.4 Ch
R COM	165 9.6 L	159 8.4 Ah	134 9.3 Lj	155 12.6 Bw	114 9.4 Ht
115919	175 10.1 L	160 8.0 Jo	138 9.0 Ah	166 12.7 Bw	115 9.3 En
124 9.6 Ch	U CEN	160 8.4 Fd	139 9.1 Ah	169 12.5 L	117 9.5 Sm
141 10.6 Pt	*122854*	160 8.6 Ah	141 9.5 Pt	172 12.6 Pt	125 9.5 Sm
148 10.5 BL	099 8.7 Ht	161 8.5 Ah	142 9.5 Lj	181 13.0 L	126 9.5 En
151 10.5 BL	099 8.7 Dr	162 8.6 HS	142 9.2 Ah		131 9.6 Ht

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J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
R HYA	RV CEN	RT CEN	Z BOO	U UMI	V BOO
132422	*133155*	*134236*	140113	141567	142539a
131 9.5 En	147 8.7 Ht	156 10.4 Sm	175 9.7 L	159 8.5 Ah	159 9.7 Fd
141 9.4 L	150 8.6 En	R CVN	Z VIR	160 8.5 Ah	159 10.1 Ah
142 9.9 Ht	T UMI	134440	*140512*	161 8.6 Ah	160 9.7 Jo
143 9.5 En	133273	132 8.5 Ah	141 14.4 L	161 8.6 Lj	160 10.0 Fd
144 9.4 Bl	142 10.0 L	135 8.5 Ah	172[14.1 L	166 8.7 Jo	160 10.2 Ah
144 9.5 Pt	143 10.3 Wd	138 8.6 Ah	184[13.8 L	172 8.5 Jo	162 10.1 Sf
149 10.2 Ht	148 10.3 BL	140 8.7 Ah	RU HYA	172 8.6 Lj	165 9.9 Fd
149 10.1 Sm	148 10.3 Sf	142 8.7 Ah	*140528*	172 8.4 Pt	165 9.9 Bc
150 9.8 En	151 10.5 BL	144 8.8 Ah	100[13.5 Ht	176 8.5 Lj	166 9.4 Jo
152 9.9 Ch	153 11.0 Sf	144 8.6 Pt	117[12.5 Sm	180 8.4 Jo	170 9.8 Sf
154 9.6 Bl	155 10.5 BL	145 8.9 Ah	126[12.6 En	183 8.3 Jo	172 9.6 Pt
154 9.8 L	155 10.7 L	145 8.7 Ch	145[13.5 Bl	183 8.8 Lj	172 8.9 Jo
165 9.7 L	157 11.0 Wk	146 8.9 Ah	155 14.0 Bl	184 8.9 Lj	173 9.6 Gb
172 9.7 Pt	165 10.8 BL	147 8.9 Ah	R CEN	188 8.9 Lj	174 8.9 Jo
175 9.8 L	170 11.6 L	148 9.3 BL	*140959*	S BOO	176 11.4 Mc
S VIR	172 11.0 BL	151 9.3 BL	099 10.6 Ht	141954	178 9.7 Dg
132706	176 11.2 BL	155 9.4 BL	099 9.7 Dr	101 12.1 Ch	180 8.8 Jo
097 10.5 Ch	182 11.6 L	155 9.0 Ah	113 10.5 Ht	142 13.5 L	180 9.4 Gb
100 10.5 Ht	188 11.8 BL	155 9.3 Fd	115 10.3 En	144 13.2 Pt	183 8.7 Jo
114 8.9 Ht	190 11.8 BL	157 9.3 Wk	117 9.7 Dr	152 13.5 Bc	183 9.3 Dg
115 9.0 En	191 11.7 BL	158 9.3 Ah	121 10.3 Sm	155 13.7 L	188 9.1 Dg
117 9.0 Sm	T CEN	159 9.3 Ah	126 10.0 En	170 13.2 L	189 9.2 Dg
119 8.5 Ch	*133633*	160 9.4 Ah	127 9.4 Dr	172 12.7 Pt	193 9.3 Fd
125 7.8 Sm	099 7.5 Dr	165 9.6 BL	131 10.3 Ht	182 12.7 L	199 8.9 Sf
126 8.2 En	100 7.9 Ht	172 9.8 BL	131 10.0 Sm	187 12.0 Jo	R CAM
131 7.3 Ht	114 6.7 Ht	172 10.0 Pt	131 9.3 En	RS VIR	142584
131 7.7 En	115 6.8 En	173 10.1 Gb	142 8.9 Dr	142205	175 9.5 Jo
142 6.8 Ht	117 6.6 Dr	176 9.9 BL	144 9.7 En	141 13.8 L	181 9.2 Jo
143 6.9 En	121 6.5 Sm	179 10.0 BL	145 9.4 Bl	154 14.2 L	183 8.7 Jo
144 6.6 Jo	126 6.5 En	187 9.9 Jo	147 9.5 Ht	172 14.2 L	R BOO
144 7.2 Pt	127 6.1 Dr	188 10.5 BL	149 9.5 Sm	184 14.0 L	143227
147 6.6 HS	131 5.9 Ht	190 10.3 BL	151 8.3 Dr	V BOO	101 12.4 Ch
148 6.7 Jo	131 6.2 Sm	191 10.4 BL	153 8.3 Dr	142539a	130 10.5 Lj
149 6.8 Ht	131 6.4 En	RX CEN	154 9.2 En	101 9.2 Ch	132 10.5 Lj
149 6.8 Sm	142 6.2 Ht	*134536*	155 8.4 Bl	142 10.6 Ah	134 10.4 Lj
150 6.7 En	143 6.2 En	100[13.1 Ht	U UMI	142 11.0 Fd	142 10.3 Ah
150 6.7 HS	145 5.8 Bl	115[13.0 En	141567	144 10.6 Ah	144 9.9 Ah
152 6.8 Ch	149 6.2 Ht	145[13.1 Bl	130 9.0 Lj	144 9.5 Pt	144 9.7 Pt
155 6.8 Jo	150 6.1 En	151 13.6 Dr	132 9.0 Lj	145 10.4 Ah	144 10.1 Lj
157 6.5 HS	151 6.3 Dr	T APS	132 8.6 Ah	146 10.6 Ah	145 10.1 Lj
157 6.8 Sm	153 6.0 Dr	*134677*	133 8.9 Lj	147 10.6 Ah	145 9.9 Ah
160 6.7 Jo	154 6.3 Bl	142 13.2 Dr	134 8.8 Ah	147 11.0 Fd	145 9.8 Ch
162 6.2 HS	156 6.4 Sm	145 13.1 Bl	135 8.7 Ah	148 11.1 Fd	146 9.7 Ah
170 6.8 HS	RT CEN	147 13.2 Ht	142 8.9 Ah	148 8.8 Gb	147 9.7 Ah
172 7.1 Pt	*134236*	151 13.1 Dr	142 8.9 Lj	149 11.3 Fd	147 10.1 Lj
173 6.6 Jo	100 12.8 Ht	155 12.9 Bl	144 8.9 Lj	151 11.1 Fd	148 10.0 Gb
181 7.0 Jo	114 12.7 Ht	RR VIR	144 8.5 Pt	151 9.8 Mc	152 9.7 Bc
183 6.7 Jo	115 13.0 En	*135908*	144 8.9 Ah	153 9.5 Jo	153 9.5 Jo
RV CEN	117 13.2 Dr	144 13.5 Pt	145 8.9 Ah	153 10.5 Fd	155 9.3 Ah
133155	126 12.6 En	172 11.6 Pt	145 8.8 Lj	155 11.1 Fd	156 9.0 Jo
099 9.3 Ht	131 11.4 Sm	Z BOO	146 9.0 Ah	155 11.3 Mc	157 9.8 Lj
113 9.5 Ht	143 11.4 En	140113	147 8.9 Ah	155 10.1 Ah	157 9.5 Wk
115 8.6 En	145 11.0 Bl	138 11.7 Pt	147 8.8 Lj	155 10.5 Sf	158 9.4 Ah
126 9.1 En	147 10.4 Ht	148 10.2 Pt	155 8.5 Ah	156 9.7 Jo	158 9.7 Lj
131 8.9 Ht	150 11.4 En	150 10.0 Ma	156 8.7 Fd	156 9.7 Ch	159 9.0 Ah
131 8.7 En	151 10.8 Dr	155 9.8 Pt	157 8.7 Wk	156 11.3 Fd	160 9.0 Ah
143 8.4 En	153 10.3 Dr	165 9.9 L	157 8.6 Lj	158 11.2 Mc	160 8.9 Jo
144 8.8 Bl	155 10.2 Bl	173 9.3 Ma	158 8.7 Ah	158 10.2 Ah	161 9.6 Lj

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J.D.Est.	Obs.	J.D.Est.	Obs.	J.D.Est.	Obs.	J.D.Est.	Obs.	J.D.Est.	Obs.	J.D.Est.	Obs.
R Boo		**S Aps**		**S Lib**		**R Nor**		**S UMi**		**R CrB**	
143227		*145971*		*151520*		*152849*		153378		154428	
166	8.5 Jo	131	10.5 Ht	146	9.9 L	114	13.3 Ht	181	8.7 Gy	137	6.0 L
172	8.3 Jo	131	10.4 Sm	154	10.4 L	117	13.0 Sm	183	8.4 Jo	137	6.1 Ah
172	8.7 Lj	131	10.1 En	169	11.2 L	127	12.7 Dr	183	8.9 Lj	138	6.1 Ah
172	8.6 Pt	142	10.3 Dr	173	13.0 Pt	145	12.5 Bl	184	8.8 Lj	138	6.0 Be
176	8.6 Lj	145	10.3 Dr	179	11.9 L	147	12.5 Ht	188	8.8 Lj	138	6.1 Lj
177	8.6 Lj	145	10.0 Bl	**S Ser**		151	11.5 Dr	199	8.6 Sf	138	6.1 L
180	8.0 Jo	147	10.3 En	151714		155	11.5 Bl	203	8.6 Mg	139	6.0 L
183	8.0 Jo	147	10.4 Ht	115	13.3 Ch	156	12.6 Sm	**U Lib**		139	6.1 Ah
183	8.2 Bc	149	10.4 Sm	132	12.7 L	**W Lib**		*153620a*		140	6.0 Gy
184	8.0 Lj	150	10.4 En	145	12.4 L	*153215*		127[	13.5 Dr	140	6.1 Ah
188	7.7 Lj	151	10.3 Dr	147	12.3 Fd	115	10.8 Ch	146[	13.1 Bl	140	6.2 Pt
189	7.7 Lj	153	10.4 Dr	155	11.9 L	127	10.9 Dr	151	12.7 Dr	140	6.0 L
V Lib		154	10.4 En	155	12.3 Fd	132	11.4 L	**T Nor**		141	6.2 Pt
143417		155	10.4 Bl	165	11.2 Ma	145	10.2 Ch	*153654*		141	6.0 L
141	12.2 L	157	10.3 En	169	11.5 L	145	11.5 Bl	099	12.5 Ht	142	6.2 Lj
154	11.5 L	**RT Lib**		173	11.4 Pt	146	11.4 L	099	12.7 Dr	142	6.1 Ah
165	10.6 L	*150018*		173	11.4 Ma	151	11.9 Dr	103	12.4 En	142	6.3 Fd
175	9.3 L	144	9.2 Pt	175	11.6 Md	154	11.6 L	113	11.7 Ht	142	6.0 L
S Lup		147	9.4 HS	179	11.5 L	155	11.6 Bl	117	10.5 Sm	143	6.0 Wd
144646a		148	9.5 Kn	**S CrB**		172	12.8 L	117	10.5 En	143	6.0 L
117	12.1 En	148	9.2 Lg	151731		183	13.9 L	121	10.5 En	144	6.0 Jo
126	12.3 En	148	9.4 Sf	114	12.8 Ch	**S UMi**		125	10.2 Sm	144	6.2 Lj
154[	12.1 En	150	9.5 HS	144	13.4 Pt	153378		127	9.6 Dr	144	6.0 Ah
U Boo		153	9.5 Sf	173	12.5 Pt	101	10.7 Ch	131	10.1 Ht	144	6.1 Pt
144918		157	9.5 HS	**RS Lib**		130	9.6 Lj	131	9.7 En	145	6.2 Lj
101	10.5 Ch	170	10.3 HS	*151822*		132	9.7 Lj	142	8.8 Dr	145	6.0 Ah
148	11.3 BL	170	10.2 Sf	100	9.8 Ht	133	9.6 Lj	142	8.9 Sm	145	6.1 L
151	11.5 BL	171	10.4 Mg	103	10.6 En	140	9.5 Gy	144	8.9 En	146	6.0 L
155	11.6 BL	172	10.5 Pt	114	11.1 Ht	142	9.4 Lj	147	8.7 Ht	146	5.9 Be
165	11.8 BL	173	10.7 Mg	115	11.0 En	143	9.3 Sf	149	8.6 Sm	146	6.1 Lj
166	11.4 Bw	180	10.7 Mg	117	11.4 Sm	144	9.2 Lj	151	8.7 Dr	146	6.0 Ah
172	11.9 BL	180	10.0 Lg	121	11.4 En	144	8.5 Pt	154	8.9 En	146	6.1 Pt
174	11.7 Bw	203	11.5 Mg	125	11.5 Sm	145	9.5 Ch	**Z Lib**		147	6.2 Lj
176	11.9 BL	**T Lib**		131	11.5 En	145	9.2 Lj	*154020*		147	6.0 Ah
188	12.1 BL	*150519*		141	12.3 L	147	9.2 Lj	127[	13.6 Dr	147	6.1 Pt
190	12.2 BL	101	11.8 Ch	144	11.7 En	147	9.5 Fd	145[	13.0 Dr	147	6.0 HS
191	12.1 BL	141	11.6 L	145	11.9 Bl	148	8.5 Lg	146[	12.7 Bl	148	6.1 Wd
195	11.9 Bw	144	11.8 Pt	147	12.1 Ht	148	8.5 Kn	151[	13.8 Dr	148	6.1 Pt
207	11.9 Bw	148	11.9 Lg	147	12.1 Sm	148	9.0 Jo	**R CrB**		148	6.0 L
Y Lup		154	12.5 L	154	12.3 L	149	9.0 Fd	154428		148	6.2 Fd
145254		172	13.8 L	154	12.3 En	150	9.0 Sf	097	6.2 Ch	149	6.2 Fd
115[	13.7 En	172	13.2 Pt	155	11.6 Bl	153	8.8 Jo	099	6.1 Ch	150	5.9 Be
131[	12.4 Sm	**Y Lib**		156	12.1 Sm	155	9.0 Fd	114	6.2 Ch	150	6.1 Lj
145[	13.7 Bl	*150605*		169	11.5 L	156	8.7 Jo	116	6.0 Gy	150	6.0 L
153[	14.1 Dr	138	10.3 L	180	11.2 L	157	9.2 Lj	124	6.1 Ch	150	6.0 HS
S Aps		144	10.6 Pt	**RU Lib**		160	8.6 Jo	129	6.0 Be	150	6.1 Wd
145971		148	10.3 Sf	*152714*		161	9.1 Lj	130	6.2 Lj	151	6.1 Pt
099	10.5 Ht	151	11.3 L	115	11.0 Ch	162	8.6 Sf	131	5.9 L	151	6.0 L
099	10.5 Dr	156	11.5 Jo	141	12.6 L	170	8.6 Sf	132	5.9 L	151	6.1 Fd
102	10.2 En	169	12.3 L	144	12.5 Pt	170	8.5 Jo	132	6.1 Lj	152	6.1 Pt
114	10.5 Ht	181	12.7 L	145	11.8 Ch	172	8.9 Lj	132	6.1 Ah	152	6.2 Ch
115	10.3 En	**S Lib**		154	13.0 L	173	8.7 Jo	133	6.1 Ah	152	6.0 Dg
117	10.5 Dr	*151520*		172	13.2 L	173	8.6 Pt	133	6.1 Lj	153	5.9 Be
121	10.4 Sm	099	9.2 Ch	183	13.6 L	175	8.6 Gy	134	6.1 Lj	153	6.0 Jo
122	10.3 En	101	9.0 Ch	**R Nor**		175	8.6 Jo	134	6.1 Ah	153	6.1 Pt
125	10.2 Sm	132	9.3 L	*152849*		176	9.2 Lj	134	6.1 Ch	153	6.0 L
126	10.2 En	144	9.7 Pt	099	13.0 Ht	177	9.0 Lj	135	6.0 Ah	154	6.0 L
127	10.4 Dr	145	10.0 Ch	099	13.0 Dr	181	8.5 Jo	135	6.1 L	155	6.1 Pt

VARIABLE STAR OBSERVATIONS RECEIVED DURING JULY AND AUGUST, 1930.

J.D.Est.	Obs.	J.D.Est.	Obs.	J.D.Est.	Obs.	J.D.Est.	Obs.	J.D.Est.	Obs.	J.D.Est.	Obs.
R CrB		R CrB		R CrB		Z CrB		U Ser		SX Her	
154428		154428		154428		155229		160210		160325	
155	5.9 Ah	175	6.0 Jo	197	6.1 Pt	169	11.7 L	151	8.4 Fd	200	8.0 Pt
155	6.0 L	176	6.0 L	199	6.1 Pt	178	11.2 Md	153	8.5 Fd	W Sco	
155	6.0 Fd	176	6.2 Lj	200	6.2 Pt	181	10.6 L	155	8.6 Fd	*160519*	
156	5.9 Be	176	6.1 Pt	200	6.0 Mg	204	9.8 Mg	157	9.5 Ma	127	12.8 Dr
156	6.0 Jo	176	6.0 Tf	201	6.1 Wd	RZ Sco		157	9.0 Wk	146	13.2 Bl
156	6.1 Pt	177	5.9 L	202	6.1 Wd	*155823*		160	8.6 Fd	151	13.0 Dr
156	6.1 L	177	6.2 Lj	X CrB		100	9.1 Ht	165	8.9 Ma	155	13.8 Bl
157	6.1 Lj	177	6.2 Fd	154536		114	8.9 Ht	173	11.1 Ma	RU Her	
157	6.1 Pt	178	6.0 Ah	101	9.8 Ch	117	8.8 Sm	173	9.8 Pt	160625a	
157	5.9 L	178	6.1 Pt	137	11.3 L	117	8.8 En	182	10.4 Dg	115	12.9 Ch
157	6.0 HS	178	6.0 Dg	144	11.6 Pt	125	8.6 Sm	184	10.2 Bc	145	13.3 L
158	6.2 Lj	179	6.1 Pt	150	11.9 Ma	126	8.9 En	188	11.1 Ma	153	13.5 Ch
158	6.1 Ah	179	5.9 L	153	12.2 L	131	8.7 Ht	189	10.3 Dg	155	13.5 L
158	6.1 Pt	180	6.0 Jo	172	12.8 L	131	8.3 En	193	11.2 Fd	172	13.6 L
158	6.0 L	180	5.9 Lg	182	12.8 L	142	8.8 Sm	213	12.4 Md	182	14.3 L
159	6.0 Ah	180	5.9 Mg	R Ser		144	8.4 Pt	X Sco		R Sco	
159	6.1 L	180	5.9 Ah	154615		144	9.0 En	*160221a*		*161122a*	
159	6.0 Tf	180	6.0 Gb	114	12.1 Ch	147	8.9 Ht	146	11.5 Bl	100	10.2 Ht
160	5.9 Jo	180	6.0 L	153	13.4 Ch	149	8.8 Sm	155	12.3 Bl	114	10.2 Ht
160	6.2 Pt	180	5.9 Tf	175[	12.6 Md	154	9.1 En	SX Her		117	10.6 Sm
160	6.0 Ah	180	6.1 Pt	V CrB		173	10.1 Pt	160325		117	10.5 En
160	6.0 L	181	6.1 Pt	154639		Z Sco		132	8.4 L	125	11.2 Sm
160	6.0 Ah	181	5.8 Gy	101	9.9 Ch	*160021*		140	8.2 Pt	126	11.0 En
161	6.1 Ah	181	5.9 L	144	8.1 Pt	100	12.0 Ht	141	8.3 Pt	131	11.2 Ht
161	6.2 Pt	182	6.3 Df	172	7.7 Md	114	11.8 Ht	144	8.3 Pt	131	11.0 En
161	6.2 Lj	182	6.0 Gb	175	6.9 Pt	117	11.5 Sm	145	8.8 L	142	11.9 Sm
162	6.1 Ah	182	6.0 L	174	11.7 Bw	117	11.8 En	146	8.8 Pt	144	12.0 Pt
162	6.0 L	182	6.1 Pt	179	7.4 BL	125	11.2 Sm	147	9.0 Pt	144	11.9 En
162	6.2 Pt	183	6.1 Pt	182	7.2 Md	126	11.2 En	148	8.9 Pt	146	12.0 Bl
162	6.0 HS	183	6.0 Lg	188	7.3 BL	131	11.4 Ht	151	8.7 Pt	147	12.2 Ht
163	6.0 L	183	6.2 Df	190	7.4 BL	131	11.0 En	152	8.7 Pt	149	11.9 Sm
164	6.0 L	183	6.0 L	191	7.2 BL	142	10.7 L	153	8.4 Pt	155	12.4 Bl
164	5.9 Tf	183	6.2 Lj	203	7.3 Mg	145	10.7 Bl	155	8.8 Pt	173	13.3 Pt
165	6.0 L	183	6.0 Tf	R Lib		146	10.8 Bl	155	8.9 L	S Sco	
166	6.0 Jo	183	6.3 Wd	*154715*		147	10.6 Sm	156	9.0 Pt	*161122b*	
168	5.8 Tf	183	5.9 Jo	141	11.9 L	147	11.0 Ht	157	8.8 Pt	114	12.4 Ht
169	5.6 Sd	184	6.1 Lg	144	11.5 Pt	154	10.6 L	158	8.8 Pt	117	12.4 En
169	6.1 Pt	184	6.0 Gb	145	11.5 Ch	154	10.8 En	160	8.8 Pt	125	11.9 Sm
169	6.0 Mg	184	6.0 L	154	10.5 L	154	10.7 En	161	9.0 Pt	126	11.9 En
169	6.0 L	184	6.2 Lj	169	10.1 L	156	10.6 Sm	163	8.5 L	131	11.5 Ht
170	5.9 Wd	185	6.1 Pt	173	10.0 Pt	169	10.3 L	172	9.0 L	131	11.5 En
170	6.1 HS	186	6.1 Pt	181	10.1 L	181	10.1 L	172	8.2 Pt	142	11.5 Sm
170	5.9 Jo	186	6.1 Mg	R Lup		R Her		173	8.1 Pt	144	11.5 Pt
170	6.0 L	186	6.0 Gb	*154736*		160118		174	7.8 Pt	144	11.3 En
171	6.0 Ah	187	6.1 Ah	127	12.2 Dr	147[	10.7 Fd	175	8.0 Pt	146	11.3 Bl
172	5.9 Mg	187	6.0 Tf	151	11.6 Dr	155[	12.0 Fd	176	8.0 Pt	147	11.5 Ht
172	6.0 L	187	6.1 Pt	RR Lib		186[	12.4 Fe	180	8.0 Pt	149	11.0 Sm
172	5.9 Wd	188	6.2 Lj	*155018*		193[	11.1 Fd	182	7.9 Pt	154	11.2 En
172	6.2 Lj	188	6.3 Wd	127	13.3 Dr	U Ser		182	8.2 L	155	10.9 Bl
172	5.9 Tf	188	5.9 Dg	142	13.9 L	160210		183	8.0 Pt	173	11.7 Pt
172	6.1 Pt	189	6.0 Gb	144	14.0 Pt	142	8.9 Fd	186	8.0 Pt	W CrB	
173	6.1 Pt	189	6.3 Lj	151	14.1 Dr	144	8.5 Fd	187	8.0 Pt	161138	
173	5.9 Jo	189	6.1 Pt	154	14.0 L	144	9.0 Bc	188	8.0 Pt	144	11.5 Pt
174	6.1 Pt	190	6.2 Pt	184	14.2 L	144	8.8 Pt	189	8.0 Pt	173	12.4 Pt
174	5.9 L	193	6.2 Fd	Z CrB		147	8.5 Fd	190	8.0 Pt	181	11.7 Jo
175	5.9 L	195	6.0 Mg	155229		148	8.5 Fd	195	8.1 Pt	W Oph	
175	6.1 Pt	195	6.1 Pt	148	12.8 L	149	8.6 Fd	197	8.0 Pt	*161607*	
175	5.9 Gy	196	6.0 Lg	155	12.6 L	150	8.8 Ma	199	8.0 Pt	142	10.8 Br

VARIABLE STAR OBSERVATIONS RECEIVED DURING JULY AND AUGUST, 1930.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
W OPH	T OPH	R DRA	S HER	RV HER	RW SCO
161607	*162815*	163266	164715	165631	*170833*
142 10.6 L	115 11.0 Ch	146 10.8 Lj	166 8.4 Jo	101 12.0 Ch	146[13.0 Bl
144 10.8 Pt	127 11.6 Dr	147 10.7 HS	173 8.3 Bc	148 14.4 L	151[13.0 Dr
148 10.5 Kn	144 12.2 Pt	150 10.7 Ma	173 8.1 Pt	155 14.4 L	Z OPH
148 10.4 Lg	146 12.0 L	150 10.7 Wd	174 8.5 Jo	176 14.3 L	171401
153 11.1 L	146 11.9 Bl	152 9.8 Bc	180 7.7 Jo	RT SCO	142 13.1 Br
163 11.6 L	151 12.7 Dr	155 11.2 Fd	182 8.1 Bc	*165636*	146 12.4 Pt
173 12.0 Pt	153 12.4 Ch	156 10.8 Fd	183 7.9 Jo	117[12.1 En	147 12.6 Bc
175 12.0 L	155 12.3 Bl	157 10.7 HS	RS SCO	129[13.0 En	158 11.7 Ch
186 12.3 Fe	155 13.0 L	157 11.2 Lj	*161844*	146[14.0 Bl	159 11.7 Ah
V OPH	170 13.1 Bw	161 11.2 Lj	099 9.3 Dr	151[13.2 Dr	173 11.5 Pt
162112	173 13.2 L	165 11.3 Ma	100 10.1 Ht	155 14.0 Bl	RS HER
115 10.0 Ch	184 13.5 L	172 11.5 Lj	114 8.5 Ht	R OPH	171723
134 10.2 Ch	S OPH	173 11.7 Lj	117 7.5 Sm	*170215*	142 12.2 Br
142 9.3 L	*162816*	173 11.4 Ma	117 7.6 En	108 7.8 Ch	146 12.1 Pt
144 9.0 Pt	115 10.6 Ch	173 11.5 Pt	125 6.3 Sm	131 8.2 HS	168 12.4 Bw
153 10.1 L	127 9.7 Dr	183 11.8 Lj	126 6.8 En	134 8.4 Ch	173 12.5 Pt
169 9.7 L	145 10.1 L	184 12.0 Lj	131 6.6 Ht	139 7.8 L	195 11.5 Bw
173 10.0 Pt	146 10.0 Bl	188 12.0 Lj	131 6.3 En	144 8.7 Fd	206 11.0 Md
181 10.5 L	151 9.9 Dr	188 11.9 Ma	142 6.5 Sm	144 8.5 Jo	207 10.9 Bw
U HER	153 9.8 Ch	193 12.2 Fd	144 6.2 En	146 8.4 Pt	S OCT
162119	155 10.2 L	RR OPH	146 6.0 Bl	147 8.6 HS	*172486*
115 11.8 Ch	155 10.2 Bl	*161319*	147 6.2 Ht	147 8.7 Fd	100 13.0 Ht
142 11.7 Br	169 10.8 L	126 11.8 En	149 6.0 Sm	148 8.7 Fd	114 13.2 Ht
144 12.5 Pt	170 11.2 Bw	144 11.2 En	151 5.9 Dr	148 8.7 HS	146 13.4 Bl
149 12.2 Fd	181 11.6 L	145 11.4 L	153 5.9 Dr	149 8.8 Fd	155 13.2 Bl
153 11.9 Ch	200 12.7 Bw	146 11.5 Pt	154 7.1 En	151 8.7 Fd	RU OPH
155 11.9 Fd	W HER	147 11.5 Sm	155 5.6 Bl	153 9.0 Jo	172809
156 11.5 Fd	163137	154 11.2 En	172 6.7 Mg	153 8.9 L	119 10.9 Ch
157 12.5 Wk	097 11.8 Ch	155 11.1 L	172 7.0 Sd	155 8.9 Fd	137 12.1 L
173 11.5 Pt	115 13.2 Ch	156 11.2 Sm	RR SCO	156 8.8 Fd	146 12.3 Pt
193 11.4 Fd	142 13.7 Br	169 10.7 L	*165030a*	156 9.1 Jo	148 12.6 L
Y SCO	144 13.1 Pt	173 10.2 Pt	099 8.1 Dr	158 9.1 HS	150 12.4 Ma
162319	149 9.3 Bc	181 9.9 L	100 8.2 Ht	160 9.3 Jo	153 13.2 Ch
132 12.7 L	153 13.4 Ch	181 9.8 Fe	114 7.4 Ht	160 8.9 Fd	155 12.9 L
146 13.4 L	156 11.5 Fd	S HER	117 7.6 Sm	163 9.2 L	162 13.7 Br
155 13.5 L	173 13.4 Pt	164715	117 7.4 En	166 9.4 Jo	163 13.4 L
172 12.3 Bw	R UMI	101 9.3 Ch	125 6.9 Sm	170 9.6 HS	173 13.5 Pt
173 13.5 L	163172	132 8.8 Ah	126 6.4 En	170 9.4 Jo	176 14.0 L
SS HER	166 8.9 Jo	133 8.8 Ah	131 6.8 Ht	173 9.5 Jo	RT SER
162807	172 9.0 Jo	134 8.9 Ah	131 6.4 En	173 9.6 Bc	173411
101 9.6 Ch	180 9.0 Jo	134 9.3 Ch	142 6.4 Sm	173 9.5 Pt	148 12.3 L
132 11.6 L	183 8.9 Jo	135 8.9 Ah	144 6.2 En	176 9.7 L	173 12.3 L
142 12.2 Br	R DRA	138 9.0 Ah	146 6.0 Bl	177 9.9 Fd	RU SCO
143 10.0 Bc	163266	142 8.9 Ah	147 5.9 Ht	177 9.7 Bc	*173543*
144 12.2 Pt	097 7.9 Ch	143 9.2 Bc	149 6.1 Sm	180 9.9 Jo	099 10.7 Dr
145 12.3 L	116 8.9 Gy	144 8.2 Jo	151 5.9 Dr	182 9.9 Dg	117 10.7 En
153 12.8 Ch	119 9.5 Ch	144 8.8 Ah	154 6.2 En	183 10.0 Jo	144 10.9 En
155 12.8 L	130 9.7 Lj	145 8.8 Ah	155 6.2 Bl	RT HER	146 10.7 Bl
163 12.4 L	132 9.9 Lj	146 8.9 Ah	SS OPH	170627	151 10.5 Dr
170 12.2 Lg	132 9.7 Ah	146 9.5 Pt	*165202*	101 13.0 Ch	155 10.4 Bl
170 12.1 Mg	134 9.9 Lj	147 8.9 Ah	146 8.9 Pt	142[14.3 Br	155 10.2 En
170 12.1 Sd	135 9.7 Ah	153 8.5 Jo	153 8.5 Ch	155[13.8 L	SV SCO
173 12.0 Pt	142 10.2 Lj	155 8.7 Ah	158 8.9 Md	173[14.3 L	*174135*
173 11.8 L	142 10.2 Br	158 8.7 Ah	172 10.0 Md	204[12.4 Mg	146[13.0 Bl
183 10.6 L	143 10.3 Wd	159 8.6 Ah	173 9.4 Pt	218[12.0 Bc	151 13.5 Dr
184 8.9 Bc	144 10.6 Lj	160 8.6 Jo	181 10.6 Fe	RW SCO	155[12.2 En
	144 10.8 Pt	160 8.5 Ah	182 11.5 Md	*170833*	
	145 10.4 Ch	161 8.7 Ah		117[12.6 En	

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J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
W PAV	R PAV	T HER	W LYR	SV DRA	R SCT
174162.	*180363*	180531	181136	183149	*184205*
117[12.3 Sm	099 9.3 Dr	176 8.4 Tf	145 8.5 Ah	139 12.5 L	119 6.8 Ch
131[13.0 Ht	100 9.8 Ht	178 8.6 Dg	145 7.9 L	155 13.0 L	130 7.0 Lj
146[13.0 Bl	114 8.5 Ht	180 8.5 Bc	146 8.4 Ah	161 13.5 Br	131 6.4 L
151 13.5 Dr	117 8.7 Sm	180 8.2 Jo	**146 8.0 Pt**	173 14.1 L	132 7.0 Lj
156[12.3 Sm	124 7.8 En	180 8.4 Tf	147 8.3 Ah	RZ HER	133 6.9 Lj
RS OPH	125 8.3 Sm	183 8.4 Jo	148 8.5 Sf	183225	134 6.8 Lj
174406	131 7.8 Ht	183 8.8 Dg	148 8.0 Wd	137 11.3 L	135 6.5 Bc
146 11.2 Pt	131 7.8 En	183 8.2 L	148 8.0 Jo	153 11.9 L	136 6.3 Bc
174 11.0 Pt	145 8.0 En	187 8.5 Tf	150 7.9 Wd	160 12.1 L	137 6.3 Bc
U ARA	147 8.3 Sm	188 8.6 Dg	153 7.8 Jo	174 12.8 L	137 6.1 L
174551	147 8.3 Ht	189 8.6 Gb	153 7.8 Sf	X OPH	138 6.3 Bc
099 8.4 Dr	151 8.2 Dr	193 8.0 Fd	155 8.3 Ah	183308	139 6.3 Bc
100 8.3 Ht	153 8.3 Dr	203 9.0 Me	155 7.8 L	119 7.3 Ch	140 6.1 Gy
114 8.2 Ht	155 8.2 En	208 9.5 Bc	157 7.6 Wk	137 7.1 L	140 6.3 Pt
117 8.4 Sm	156 8.5 Sm	215 9.9 Bc	158 8.1 Ah	144 7.3 Jo	141 6.2 Pt
125 8.6 Sm	T HER	218 10.7 Bc	159 8.2 Ah	145 6.9 L	142 5.5 Fd
131 8.5 Ht	180531	W DRA	160 8.1 Ah	146 7.2 Pt	142 5.9 Lj
145 10.0 En	124 11.9 Ch	180565	160 7.7 Jo	147 7.2 Fd	143 6.1 Bc
147 9.8 Sm	132 10.8 L	139 10.0 L	161 8.1 Ah	153 6.8 Jo	143 6.7 Wd
147 10.1 Ht	135 10.3 Ah	146 9.7 Pt	162 7.8 Sf	155 6.9 L	144 6.1 Bc
151 10.0 Dr	142 9.7 Ah	153 10.1 L	166 7.7 L	155 7.2 Fd	144 6.1 Jo
155 10.8 En	142 10.0 Bc	154 10.4 Ch	166 8.0 Wd	156 6.8 Jo	144 6.1 Lj
156 10.8 Sm	144 9.8 Ah	173 11.5 L	170 7.8 Wd	159 7.0 Bc	144 6.1 Pt
RT OPH	144 10.8 Fd	174 11.7 Pt	170 7.7 Sf	160 6.9 Jo	144 5.7 Fd
175111	145 9.6 Ah	178 11.9 Md	172 8.1 Wd	165 6.6 L	145 6.1 Lj
148 12.4 L	145 9.5 L	X DRA	174 7.4 Pt	166 6.7 Jo	145 5.9 L
155 13.0 L	146 9.6 Ah	180666	176 8.9 L	170 6.7 Jo	145 6.8 Ch
173 13.3 L	146 9.6 Bc	139 11.5 L	188 8.2 Ba	173 6.5 Jo	146 6.1 Bc
RY HER	146 9.6 Pt	153 10.7 L	188 8.5 Wd	174 6.9 Pt	146 6.2 Lj
175519	147 9.6 Ah	173 11.5 L	193 8.6 Fd	175 6.6 Jo	146 6.2 Pt
119 10.6 Ch	147 9.6 Bc	178 11.7 Md	RV SGR	176 6.8 L	147 6.1 Bc
137 8.9 L	149 9.6 Bc	NOV OPH	*182133*	180 6.4 Jo	147 6.4 Bz
146 8.3 Pt	149 9.1 Fd	180911	145 8.7 En	183 6.6 Jo	147 6.4 Gb
150 8.7 Ma	152 8.7 L	146[13.0 Pt	146 8.1 Bl	RS DRA	147 6.0 Lj
151 8.6 Mg	152 9.2 Ch	174[12.0 Pt	147 8.3 Sm	184074	147 6.1 Pt
152 8.6 Ch	155 9.2 Bc	TV HER	147 8.3 En	119 12.0 Ch	147 6.0 Fd
153 8.4 L	155 8.6 Ah	181031	155 8.8 En	RY LYR	148 6.2 Fd
158 8.7 Md	155 8.8 Fd	137 13.6 L	155 8.3 Bl	184134	148 5.9 Be
162 8.5 Br	157 9.2 Wk	153 13.8 L	156 8.3 Sm	115 9.7 Ch	148 6.1 Bc
163 8.7 L	158 9.0 Bc	163 14.2 L	SV HER	137 10.0 L	148 6.1 Gb
165 8.7 Ma	158 8.5 Ah	173 14.3 L	182224	144 10.5 Jo	148 5.9 Lg
168 8.8 Bw	158 8.5 HS	RY OPH	145 13.7 L	146 10.5 Pt	148 6.6 Wd
173 8.9 Ma	159 8.5 Ah	181103	146 13.6 Pt	148 11.0 Jo	148 6.1 Pt
174 9.2 Md	159 8.9 Tf	132 9.8 Ah	155 14.0 L	153 11.2 Jo	149 6.2 Bc
174 8.7 Pt	160 8.5 Fd	142 11.3 Br	173 14.4 L	153 10.5 L	149 5.8 Lg
176 8.9 L	160 8.7 Ah	146 12.2 Pt	T SER	160 10.6 L	149 6.4 Wd
188 9.1 Ma	161 8.6 Ah	W LYR	182306	160 11.5 Jo	149 6.1 Fd
209 10.5 Md	162 8.5 HS	181136	142 11.7 Br	161 11.0 Br	150 6.3 Ma
V DRA	163 8.5 L	132 8.7 L	146 11.7 Pt	166 11.4 Jo	150 5.9 Be
175654	165 8.4 Bc	132 8.7 Ah	150 11.6 Bw	170 11.8 Sd	150 6.3 Wd
140 12.8 L	165 8.4 Fd	133 8.7 Ah	161 10.4 Br	170 11.8 Mg	150 6.0 Lj
146 13.0 Pt	170 8.2 HS	135 8.6 Ah	166 10.0 Bw	170 11.7 Lg	151 5.8 Mc
153 13.2 L	170 7.9 Jo	138 8.6 Ah	174 9.8 Bw	172 11.6 Jo	151 6.1 Bc
154 13.4 Ch	172 8.4 Tf	139 8.6 Ah	174 9.3 Pt	174 11.4 L	151 6.0 Pt
162 13.6 Br	173 8.4 Bc	142 8.7 Ah	180 9.3 Lg	174 11.4 Pt	151 6.0 Fd
173 14.3 L	173 8.0 Jo	143 8.1 Wd	180 9.9 Mg	180 11.8 Jo	152 6.0 Be
	173 8.3 L	144 8.2 Jo		188 13.0 Ba	152 6.1 Bc
	174 8.0 Pt	144 8.5 Ah			152 6.0 Pt

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J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
R SCT	R SCT	R SCT	RX LYR	R AQL	RW SGR
184205	*184205*	*184205*	185032	190108	*190819a*
153 5.8 Jo	174 5.8 Jo	189 5.7 Lj	188 12.8 Ba	119 8.9 Ch	131 9.6 Ht
153 5.9 Pt	175 5.6 Jo	189 5.5 Pt	S CRA	132 9.6 Ah	140 9.6 L
153 6.0 L	175 5.9 Gy	190 5.4 Pt	*185437a*	134 9.5 Ah	145 10.0 En
153 6.0 Fd	175 5.9 Pt	191 5.4 Pt	100 11.8 Ht	135 9.7 Ah	147 9.9 Ht
154 6.0 Gb	176 5.9 Pt	191 4.8 Ma	114 11.5 Ht	135 9.4 Ch	148 9.5 Pt
155 5.7 Mc	176 5.3 Tf	191 5.5 Mg	117 11.7 Sm	142 9.9 Ah	149 9.6 Sm
155 6.1 Bc	176 5.8 Lj	192 5.4 Fd	125 11.7 Sm	144 9.8 Ah	150 9.7 Ma
155 6.5 Pt	177 5.6 Lg	192 5.0 Bc	145 12.0 En	145 9.9 Ah	153 10.0 Ch
155 5.8 Fd	177 5.6 Lj	193 5.5 Fd	146 11.9 Bl	146 10.0 Ah	154 9.9 L
156 5.9 Fd	177 5.6 Bc	193 5.0 Bc	147 11.9 Ht	146 10.0 Pt	155 10.3 En
156 5.9 Be	177 5.1 Dg	195 5.2 Pt	147 11.7 Sm	147 10.1 Ah	157 10.4 Sm
156 5.7 Lg	177 5.6 Fd	195 4.7 Ma	155 11.6 Bl	147 9.6 Fd	165 9.9 L
156 6.5 Pt	178 5.8 Pt	195 5.4 Mg	155 11.7 En	155 10.4 Ah	165 10.2 Ma
156 6.5 Ch	179 5.7 Pt	196 5.0 Lg	156 12.2 Sm	155 10.9 Fd	173 10.6 Bw
157 5.9 Lj	179 5.0 L	197 5.0 Bc	ST SGR	157 11.0 Ch	173 10.1 Ma
157 6.1 Pt	179 5.6 Bc	198 5.4 Bc	*185512a*	158 10.4 Ah	174 10.4 Pt
157 5.9 Jo	180 5.6 Bc	198 5.2 Mg	145 13.1 L	159 10.6 Ah	180 10.5 L
158 5.5 Mc	180 5.5 Jo	199 5.3 Md	155 12.3 L	160 10.5 Ah	191 10.1 Ma
158 6.1 Bc	180 5.7 Lg	199 5.3 Pt	165 12.1 L	174 11.3 Pt	200 9.9 Bw
158 5.9 Lj	180 5.6 Mg	199 5.2 Bc	176 11.8 L	V LYR	207 10.2 Bw
158 6.3 Pt	180 5.9 Gb	200 5.3 Mg	R CRA	190529a	BH SGR
159 6.1 Bc	180 5.2 Tf	200 5.2 Pt	*185537a*	142 12.3 Br	*190819b*
159 6.4 Fd	180 5.4 Pt	201 5.9 Wd	100 12.5 Ht	153 11.3 Ch	154 12.3 L
160 6.1 Jo	181 5.6 Pt	202 5.8 Wd	116 12.0 Ht	170 9.9 Lg	165 12.0 L
160 6.1 Pt	181 5.6 Lg	203 5.4 Mg	117 12.5 Sm	170 9.6 Mg	179 12.2 L
160 6.2 Fd	181 5.5 Gy	203 5.5 Me	145 12.6 En	170 9.9 Sd	TY AQL
160 5.8 L	182 5.4 Bc	203 5.8 Bc	146 13.0 Bl	174 9.8 Pt	*190907*
161 6.0 Lj	182 5.5 Lg	207 5.8 Bc	147 12.5 Ht	178 9.9 Md	148 10.4 Pt
161 6.1 Pt	182 5.3 Me	208 6.0 Bc	155 12.4 Bl	184 9.8 Br	155 11.7 Fd
162 6.0 Pt	182 5.9 Gb	211 6.0 Bc	155 12.5 En	188 10.6 Ba	174 10.5 Pt
164 6.0 Bc	182 5.9 Df	212 5.9 Bc	T CRA	RX SGR	174 11.0 Bw
164 5.9 Tf	182 5.5 Pt	213 5.9 Bc	*185537b*	*190818*	S LYR
165 5.7 L	183 5.5 Pt	215 5.8 Bc	146 13.3 Bl	100 10.3 Ht	190925
165 6.2 Ma	183 5.5 Lg	216 5.5 E	147 12.7 Ht	116 9.9 Ht	115[12.6 Ch
165 6.0 Bc	183 5.0 Lj	216 5.5 C	155 13.0 Bl	119 10.4 Ch	160[14.4 L
165 5.9 Fd	183 4.9 Tf	218 5.9 Bc	Z LYR	131 10.3 Ht	184 13.5 Br
166 5.5 Jo	183 5.6 Wd	219 6.0 Bc	185634	140 10.3 L	188[13.5 Ba
166 6.0 Bc	183 5.4 Bc	RW LYR	137 12.8 L	145 10.1 En	X LYR
166 5.9 Wd	183 5.6 Jo	184243	153 12.5 L	147 10.3 Ht	190926
168 5.6 Tf	184 5.4 Bc	188[13.4 Ba	153 12.2 Ch	148 10.5 Pt	148 9.0 Pt
169 5.6 Mg	184 5.5 Lg	NOV AQL	160 12.3 L	149 9.9 Sm	174 9.0 Pt
169 5.7 Pt	184 5.9 Gb	184300	162 11.8 Br	150 10.0 Ma	RS LYR
170 5.8 Sd	184 5.0 Lj	119 10.8 Ch	170 11.4 Mg	154 10.3 L	190933a
170 5.7 Lg	185 5.4 Lg	140 11.7 Pt	170 11.5 Lg	155 10.2 Ch	115 11.4 Ch
170 6.0 Wd	185 5.5 Pt	144 11.7 Pt	170 11.6 Sd	155 10.4 En	139 11.8 L
170 6.0 Bc	186 5.6 Pt	148 11.7 Pt	174 11.0 Pt	157 10.5 Sm	142 12.5 Br
172 5.6 Ma	186 5.4 Lg	151 11.7 Pt	177 10.2 L	165 10.9 L	148 12.2 Pt
172 6.1 Bc	186 5.6 Mg	160 11.6 Pt	SU SGR	173 11.0 Bw	153 12.6 L
172 5.5 Jo	186 5.9 Gb	165 10.7 Ma	*185722*	174 11.2 Pt	153 12.8 Ch
172 5.8 Mg	187 4.9 Tf	172 11.6 Pt	100 8.1 Ht	180 11.3 L	160 12.7 L
172 6.9 Gb	187 5.4 Pt	173 10.5 Ma	116 8.6 Ht	182 11.6 Ma	173 13.4 Bw
172 5.3 Tf	188 5.3 Pt	180 11.7 Pt	131 8.2 Ht	206 11.9 Bw	174 13.3 Pt
172 5.2 L	188 5.7 Wd	186 11.7 Pt	147 8.1 Ht	207 12.1 Bw	177 13.4 L
172 5.8 Pt	188 4.8 Ma	188 10.4 Ma	RT LYR	RW SGR	RU LYR
173 6.1 Bc	188 5.4 Lj	200 11.6 Pt	185737	*190819a*	190941
173 5.8 Pt	188 5.0 Dg	RX LYR	153 14.6 L	100 9.3 Ht	115[12.3 Ch
173 6.0 Gb	189 5.1 Df	185032	162 14.1 Br	116 9.6 Ht	160[14.5 L
174 5.8 Pt	189 5.9 Ld	174 14.5 L	174 13.1 L	119 9.6 Ch	184[13.8 Br

VARIABLE STAR OBSERVATIONS RECEIVED DURING JULY AND AUGUST, 1930.

J.D.Est.	Obs.	J.D.Est.	Obs.	J.D.Est.	Obs.	J.D.Est.	Obs.	J.D.Est.	Obs.	J.D.Est.	Obs.
U DRA		RY SGR		SW SGR		RT AQL		R CYG		RT CYG	
190967		*191033*		*191331*		193311		193449		194048	
140	13.4 L	129[	12.5 En	099	13.1 Dr	165	11.2 Ma	183	7.5 Jo	156	6.8 Jo
153	13.3 Ch	132	12.9 L	146	11.9 Bl	170	11.4 L	184	7.1 Dg	158	7.3 Ah
154	13.2 L	135[	12.4 Dr	153	12.0 Dr	174	11.1 Pt	187	7.3 Dg	159	7.4 Ah
162	12.9 Br	144[	12.5 En	155	11.6 Bl	177	11.0 L	188	6.6 Ma	160	7.2 Fd
172	12.4 L	145	13.1 Dr	TZ CYG		182	10.6 Ma	188	8.0 Wd	160	7.5 Ah
174	12.4 Pt	147	13.3 Dr	191350		188	9.5 Ma	189	7.3 Dg	160	6.8 Jo
180	12.5 Mg	150	13.0 L	148	10.0 Pt	R CYG		191	7.0 Br	161	7.5 Ah
180	12.5 Lg	151	13.0 Dr	174	9.5 Pt	193449		193	6.5 Fd	166	7.1 Jo
193	11.9 Fd	152	12.8 L	180	10.2 Mg	115	9.5 Ch	199	7.1 Ba	172	7.2 Jo
W AQL		153	13.1 Dr	180	10.2 Lg	132	8.7 Ah	201	7.9 Wd	172	7.4 Wd
191007		153	13.1 L	U LYR		133	8.5 Ah	203	7.5 Me	174	7.7 Pt
162	13.5 Br	154	12.7 L	191637		134	8.4 Ah	207	7.5 Bc	180	8.0 Jo
174	13.7 Bw	155	12.8 L	142	10.0 Fd	135	8.3 Ah	216	7.8 C	183	8.1 Jo
T SGR		155	13.0 Bl	144	10.0 Fd	138	8.4 Ah	RV AQL		199	9.3 Ba
191017		158	12.8 L	148	9.3 Pt	139	8.4 Ah	193509		TU CYG	
119	11.5 Ch	159	12.8 L	148	10.1 Fd	142	8.3 Ah	145	13.9 L	194348	
146	12.8 L	160	12.8 L	151	10.0 Fd	142	6.9 Fd	154	14.1 L	108	9.7 Ch
148	12.5 Pt	160	13.0 Dr	155	10.1 Fd	143	8.6 Wd	162	13.4 Br	119	9.3 Ch
153	12.3 Ch	162[	13.0 L	156	9.9 Fd	144	8.5 Jo	165	13.3 L	138	9.7 L
155	10.3 Fd	163	12.8 L	165	9.1 Bc	144	8.0 Ah	177	12.8 L	148	10.7 Pt
155	12.5 L	172[	13.0 L	174	8.8 Pt	144	7.4 Fd	188	12.1 Ba	152	10.9 L
165	12.1 L	173	13.5 L	193	10.8 Fd	145	7.8 Ah	T PAV		154	10.7 Ch
174	12.0 Pt	174[	12.0 Pt	AF CYG		146	7.7 Ah	*193972*		155	11.0 Fd
180	12.3 L	175[	12.0 Pt	192745		147	7.6 Ah	099	13.4 Dr	156	11.0 Fd
R SGR		176[	12.0 Pt	132	6.7 Ah	147	7.0 Fd	100	13.4 Ht	166	12.1 L
191010		177[	12.0 L	133	6.7 Ah	148	7.3 Fd	146[	13.9 Bl	174	12.2 Pt
100	9.9 Ht	179	13.3 L	134	6.9 Ah	148	7.3 Pt	153[	13.6 Dr	177	12.5 Br
116	8.8 Ht	180[	13.3 L	135	6.8 Ah	148	8.4 Wd	156[	12.1 Sm	179	13.2 L
119	8.8 Ch	182[	12.5 L	138	6.8 Ah	149	6.7 Fd	RT CYG		X AQL	
131	8.2 Ht	184	13.3 L	139	7.2 Ah	150	7.2 Ma	194048		194604	
138	7.8 L	188[	12.0 Pt	142	7.2 Ah	150	8.4 Wd	108	8.5 Ch	148	14.2 L
147	7.5 Sm	200[	11.5 Pt	144	7.3 Ah	151	6.6 Bc	119	7.3 Ch	156	14.0 L
148	7.5 Pt	TY SGR		145	7.3 Ah	151	7.3 Fd	132	7.5 Ah	162	13.6 Br
150	7.3 L	*191124*		146	7.3 Ah	153	7.5 Jo	133	7.2 Ah	165	13.4 L
153	7.3 Ch	099	10.2 Dr	147	7.3 Ah	154	7.9 Ch	133	7.2 Ch	177	13.1 L
155	7.1 En	146[	12.4 Bl	155	7.7 Ah	155	7.6 Ah	134	7.2 Ah	187	12.9 Tf
156	7.5 Sm	153	12.0 Dr	158	7.8 Ah	155	7.3 Fd	135	7.3 Ah	X CYG	
158	7.0 L	156[	12.1 En	159	7.6 Ah	156	7.3 Fd	138	7.2 Ah	194632	
165	7.0 L	S SGR		160	7.4 Ah	156	7.6 Jo	139	7.3 Ah	115	11.6 Ch
174	7.1 Pt	*191319a*		161	7.4 Ah	158	7.3 Ah	142	7.2 Ah	135	11.3 Ch
180	7.0 L	146	11.4 Bl	TY CYG		159	7.5 Bc	142	7.1 Fd	142	10.5 Ah
203	8.3 Me	147	11.3 Ht	192928		159	7.2 Ah	144	7.3 Fd	144	10.5 Ah
RY SGR		147	11.4 Sm	115	9.5 Ch	160	7.2 Ah	144	7.2 Ah	144	9.7 Jo
191033		150	11.5 L	135	9.8 Ch	160	6.5 Fd	144	7.5 Jo	145	10.5 Ah
070	9.2 Dr	155	11.1 En	138	9.6 L	160	7.6 Jo	145	7.3 Ah	146	10.4 Ah
077	9.2 Dr	155	10.9 Bl	148	10.4 Pt	161	7.1 Ah	146	7.3 Ah	148	10.7 Mg
079	9.1 Dr	156	11.1 Sm	152	10.8 L	166	7.5 Jo	147	7.3 Ah	148	9.0 Jo
082	8.9 Dr	158	11.0 L	160	11.3 L	166	7.5 Wd	147	7.2 Fd	148	10.6 Pt
089	9.7 Dr	165	10.1 L	162	10.9 Br	170	8.0 Wd	148	7.1 Fd	153	8.8 Jo
096	11.3 Dr	174	10.4 Pt	174	12.0 Pt	172	6.6 Ma	148	7.0 Pt	154	9.8 Ch
099	12.1 Dr	180	10.1 L	176	12.0 L	172	7.4 Jo	149	7.2 Fd	155	9.6 Ah
100	12.5 Ht	— SGR		188	12.0 Ba	172	8.1 Wd	150	7.2 Wd	156	8.8 Jo
116[	12.5 Ht	*191319b*		RT AQL		174	7.1 Pt	151	7.1 Fd	157	9.4 Ch
117	12.5 Dr	174	12.5 Pt	193311		177	7.1 Dg	153	7.0 Jo	158	9.5 Ah
119[	11.0 Ch	Z SGR		140	12.9 L	180	7.1 Dg	154	7.0 Ch	160	9.0 Jo
122[	12.5 En	*191321*		148	13.0 Pt	180	7.4 Jo	155	7.3 Ah	160	9.3 Ah
124[	12.5 En	147	9.3 En	152	12.8 L	182	7.0 Dg	155	7.3 Fd	166	8.2 Jo
127	12.7 Dr	156	11.6 En	162	11.7 Br	182	6.6 Ma	156	7.2 Fd	169	8.3 Mg

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J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
χ CYG	RR AQL	BU CYG	Z AQL	SX CYG	U CYG
194632	*195202*	200250	*200906*	201130	201647
170 8.1 Lg	148[13.1 L	172 12.0 Lj	159 10.2 Fd	115 12.0 Ch	148 9.7 Fd
170 8.2 Sd	156 13.9 L	176 12.0 Lj	174 11.7 Bw	142 12.8 L	149 9.5 Fd
172 8.0 Sd	162[13.1 Br	177 12.1 Lj	174 12.8 Pt	150 13.1 Bw	150 10.8 Sf
172 7.5 Bc	176[13.1 L	183 12.4 Lj	R SGE	156 13.2 L	151 9.6 Fd
172 8.0 Mg	RS AQL	184 12.4 Lj	200916	176 13.6 L	151 9.2 Pt
172 7.7 Jo	*195308*	188 12.6 Lj	199 8.7 Ba	177 13.5 Br	153 9.8 Jo
173 7.7 Ma	138 11.1 L	189 12.6 Lj	RS CYG	RT SGR	153 9.9 Fd
174 7.7 Pt	152 10.3 L	S CYG	200938	*201139*	155 9.9 Fd
174 7.6 Jo	161 10.3 L	200357	115 8.2 Ch	099 11.4 Dr	156 9.9 Fd
177 7.5 Br	162 10.4 Br	115[12.8 Ch	133 8.8 Ch	146 10.3 Bl	156 9.3 Jo
180 7.3 Mg	176 12.3 L	148[14.3 L	138 8.2 L	153 9.8 Dr	160 9.0 Jo
180 7.1 Jo	NOV CYG	177[13.8 Br	144 8.3 Jo	155 9.6 Bl	162 9.8 Sf
180 7.2 Lg	195553	188[12.2 Md	145 8.8 Ch	WX CYG	165 9.4 Fd
182 7.1 Ma	140[12.0 Pt	199[12.8 Ba	147 8.4 Fd	201437b	165 9.5 Bc
183 7.0 Jo	144[12.2 Pt	219 9.0 Bc	147 8.7 Gb	115 9.5 Ch	166 9.0 Jo
186 6.8 Mg	151[12.2 Pt	R CAP	148 8.6 Fd	138 9.0 L	170 9.8 Sf
187 7.3 Me	161[12.2 Pt	*200514*	150 8.1 L	144 10.5 Jo	172 9.9 Wd
188 6.8 Ma	172[12.2 Pt	148 13.4 L	151 8.5 Fd	150 9.0 L	172 8.8 Jo
188 6.6 Wd	183[12.2 Pt	151 13.2 Pt	151 8.2 Pt	151 11.0 Pt	173 10.0 Wd
191 6.7 Mg	186[12.2 Pt	156 13.5 L	153 8.3 Jo	153 10.7 Jo	174 8.7 Pt
195 6.7 Mg	200[12.2 Pt	174 13.0 Pt	155 8.7 Fd	155 9.5 Fd	174 8.6 Jo
199 6.5 Ba	RR TEL	179 13.3 L	156 8.2 Jo	156 10.7 Jo	174 9.5 Md
200 6.7 Mg	*195656*	S AQL	157 8.8 Ch	156 10.5 Ch	180 8.8 Jo
201 6.4 Wd	100[12.6 Ht	200715a	158 8.1 L	158 9.4 L	183 8.6 Jo
202 6.2 Wd	147[12.6 Ht	119 9.0 Ch	160 8.3 Jo	159 10.4 Fd	188 9.4 Wd
203 6.8 Me	Z CYG	151 10.5 Pt	166 8.2 Jo	160 11.4 Jo	193 8.2 Fd
219 6.1 Bc	195849	159 10.8 Fd	166 8.1 L	166 10.5 Jo	199 9.4 Sf
S PAV	106 12.4 L	172 11.9 Mg	172 8.2 Jo	166 9.7 L	U MIC
194659	115 9.9 Ch	172 11.9 Sd	172 8.5 Gb	172 10.6 Jo	*202240*
099 7.6 Dr	133 10.9 Ch	174 11.6 Pt	174 8.0 Jo	174 10.7 Jo	099 9.0 Dr
147 7.7 En	142 11.2 L	199 11.9 Ba	174 8.1 Pt	174 10.7 Md	146 8.5 Bl
153 7.2 Dr	148 11.4 Pt	RW AQL	179 8.0 L	174 10.2 Pt	153 8.7 Dr
156 7.7 En	154 12.1 L	200715b	180 8.1 Jo	179 10.2 L	155 8.8 Bl
RR SGR	174 12.2 Pt	151 9.5 Pt	180 8.3 Gb	180 10.5 Jo	Z DEL
194929	177 12.9 Br	172 9.2 Sd	183 8.2 Jo	183 10.5 Jo	202817
099 5.6 Dr	179 13.0 L	174 9.5 Pt	189 8.6 Df	206 11.1 Md	145 12.5 L
147 9.2 Bl	199 12.5 Ba	180 9.4 Mg	189 8.9 Ld	V SGE	151 11.7 Pt
153 9.2 Dr	S TEL	199 9.0 Ba	189 8.4 Gb	201520	156 12.5 L
155 9.8 Bl	*195855*	R TEL	193 8.1 Fd	177 12.0 L	166 10.8 L
156 9.7 Sm	100 12.8 Ht	*200747*	193 8.2 Gb	178 12.0 L	172 9.8 Ma
RU SGR	146 12.9 Bl	099 10.5 Dr	R DEL	179 12.0 L	174 9.2 Pt
195142	147 12.9 Ht	146 12.4 Bl	201008	180 12.5 L	177 9.7 Br
099 8.3 Dr	SY AQL	153 12.6 Dr	145 10.9 L	182 11.9 L	177 9.6 L
100 8.4 Ht	200212	155 12.8 Bl	151 11.5 Pt	182 12.7 L	188 9.1 Ma
116 10.1 Ht	148 14.6 L	RU AQL	156 11.6 L	183 11.9 L	ST CYG
125 9.7 Sm	156 14.6 L	200812	159 9.8 Fd	183 12.6 L	202954
131 10.5 Ht	174 13.8 Pt	146 14.1 L	172 12.0 L	184 11.8 L	115 10.8 Ch
131 10.8 En	BU CYG	156 14.2 L	174 12.2 Pt	184 12.0 L	138 10.0 L
145 10.9 En	200250	176[14.3 L	177 12.1 Br	184 12.3 L	151 11.0 Pt
146 11.5 Bl	130 10.8 Lj	188[12.3 Ma	180 11.8 Mg	194 12.0 Br	153 10.4 L
147 11.6 Sm	132 10.9 Lj	W CAP	180 12.5 Lg	U CYG	166 10.7 L
147 11.6 Ht	133 10.9 Lj	*200822*	183 12.1 L	201647	174 11.5 Pt
153 11.8 Dr	142 10.9 Lj	151 13.0 Pt	RT CAP	115 10.4 Ch	175 11.1 Md
155 11.7 Bl	144 10.8 Lj	155 13.3 Bl	*201121*	142 9.6 Fd	177 11.0 Br
156 11.8 Sm	145 10.8 Lj	174 11.1 Pt	151 6.7 Pt	144 9.6 Fd	180 10.7 L
156 11.9 En	147 10.9 Lj	Z AQL	174 6.8 Pt	144 10.2 Jo	
	157 10.9 Lj	*200906*		145 10.4 Ch	
	161 11.1 Lj	151 10.0 Pt		147 9.6 Fd	

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J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
V VUL	V AQR	X DEL	R EQU	Y PAV	RU CYG
203226	204102	205017	210812	*211570*	213753
151 8.6 Pt	138 8.1 L	162 12.8 Br	131 13.8 L	147 5.9 Ht	147 10.0 Ah
174 8.9 Pt	151 7.8 Pt	172 12.7 L	151 13.8 L	X PEG	152 9.4 Pt
R MIC	152 7.9 L	182 13.2 L	161 14.2 L	211614	155 9.9 Ah
203429	161 7.8 L	RR CAP	162 14.5 Br	137 10.8 L	158 9.9 Ah
155 11.3 Bl	174 8.2 Pt	*205627*	177 12.5 Br	150 10.6 L	174 9.1 Bw
Y DEL	179 8.1 L	099 9.6 Dr	180 13.9 L	151 10.5 Pt	180 8.9 Pt
203611	188 8.6 Md	153 13.0 Dr	210 12.4 Md	159 10.8 Fd	RV CYG
148 13.9 L	W AQR	T OCT	T CEP	162 10.4 Br	213937
156 13.9 L	*204104*	*205782*	210868	173 10.1 Ma	152 6.8 Pt
177 13.9 Br	138 9.3 L	099 12.7 Dr	119 10.2 Ch	175 10.0 L	180 6.6 Pt
179 14.2 L	152 9.2 L	153 8.4 Dr	132 10.5 Ah	180 9.8 Pt	199 7.0 Ba
S DEL	161 9.5 L	R VUL	135 10.5 Ah	184 9.6 L	RR PEG
203816	179 10.4 L	205923a	142 10.2 Fd	184 10.1 L	214024
130 9.9 Lj	184 10.2 Br	151 10.9 Pt	144 10.4 Fd	191 9.7 Br	177 13.7 Br
132 9.8 Lj	U CAP	158 10.3 Ah	144 10.1 Jo	T CAP	180 13.6 Pt
134 9.8 Lj	*204215*	159 10.0 Ah	144 10.5 Ah	*211615*	R GRU
142 9.8 Lj	145 12.3 L	160 10.0 Ah	145 10.4 Ah	138 12.8 L	*214247*
145 9.5 Lj	155 12.2 Bl	168 9.2 Jo	145 10.9 Ch	151 12.8 L	099 10.0 Dr
147 9.5 Lj	156 12.1 L	172 8.8 Jo	146 10.4 Ah	155 13.0 Bl	147 12.6 Ht
151 9.0 Pt	161 12.2 L	174 8.1 Pt	147 10.4 Ah	161 13.2 L	153 12.9 Dr
153 9.2 Lj	175 12.6 L	175 8.7 Jo	147 10.3 Fd	180 14.1 L	155 12.8 Bl
157 9.4 Lj	V DEL	177 8.5 Br	148 10.0 Fd	S MIC	157 12.9 Sm
158 9.3 Lj	204318	180 8.5 Jo	149 10.0 Fd	*212030*	V PEG
161 9.3 Lj	131 14.4 L	183 8.2 Jo	151 9.9 Pt	099 9.4 Dr	215605
174 9.7 Jo	148 14.1 L	187 8.0 Jo	153 9.7 Jo	153 13.7 Dr	132 11.8 L
174 8.8 Pt	162 13.8 Br	V CAP	153 9.8 Fd	155[13.4 Bl	151 12.6 L
174 9.0 Md	172 12.8 L	*210124*	155 9.8 Fd	Y CAP	152 12.7 Pt
176 9.6 Lj	177 12.0 Br	099 12.3 Dr	155 10.3 Ah	*212814*	169 13.1 L
177 9.4 Lj	182 11.7 L	153[13.4 Dr	156 9.8 Jo	145[13.1 L	177 13.8 Br
183 9.3 Lj	184 11.0 Br	155[12.5 Bl	156 9.7 Fd	155[13.1 Bl	180 13.4 Pt
184 9.4 Lj	191 10.9 Dr	TW CYG	158 10.1 Ah	156[14.3 L	181 14.1 L
188 9.5 Lj	T AQR	210129	159 10.1 Ah	180 12.0 L	U AQR
189 9.2 Lj	*204405*	131 11.4 L	160 9.5 Jo	W CYG	*215717*
189 8.8 Md	151 11.0 Pt	145 10.9 L	160 10.0 Ah	213244	132 13.3 L
V CYG	174 7.4 Pt	157 10.1 L	165 9.3 Fd	131 5.4 L	151 13.5 L
203847	175 7.7 Jo	172 9.3 L	165 9.4 Bc	142 5.5 L	152 13.5 Pt
115 12.0 Ch	180 7.5 Jo	177 9.6 Br	166 9.0 Jo	150 5.8 L	180 14.2 L
142 12.0 L	183 7.4 Jo	179 9.7 Md	172 8.6 Jo	152 5.5 L	RT PEG
151 12.3 Pt	184 7.5 Br	182 9.8 L	175 10.0 Gy	158 5.8 L	215934
157 12.3 L	187 7.2 Jo	X CAP	180 9.0 Pt	169 5.7 L	132 14.0 L
166 11.5 L	207 7.4 Bc	*210221*	181 9.8 Gy	179 5.9 L	148 13.2 L
172 10.1 Ma	RZ CYG	155 12.4 Bl	181 8.6 Jo	S CEP	169 11.5 L
173 8.8 Jo	204846	X CEP	183 8.5 Jo	213678	181 10.6 L
174 10.0 Pt	151 12.8 Pt	210382	183 9.0 Bc	151 9.0 Pt	RY PEG
177 11.5 Br	174 12.0 Pt	131 10.7 L	RR AQR	155 10.2 Fd	*220133a*
180 8.5 Jo	191 11.4 Br	150 9.4 L	*210003*	156 9.7 Fd	149 10.5 Fd
180 10.7 L	199 10.5 Ba	161 9.3 L	131 14.5 L	177 9.8 Br	180 11.8 Pt
183 8.4 Jo	S IND	162 9.7 Br	148 14.1 L	178 9.4 Md	RZ PEG
188 8.8 Ma	*204054*	180 9.6 L	161 14.2 L	180 8.5 Pt	220133b
Y AQR	146 12.9 Bl	188 9.8 Br	175 13.6 L	181 11.5 Jo	132 11.9 L
203005	147 13.1 Ht	RS AQR	180 12.4 Pt	RU CYG	151 11.8 L
184[13.3 Br	153 11.8 Dr	*210504*	184 12.0 L	213753	152 11.8 Pt
T DEL	155 12.0 Bl	131 12.7 L	184 12.3 Br	132 9.9 Ah	175 12.2 L
204016	X DEL	151 13.6 L	Y PAV	134 9.8 Ah	180 12.0 Pt
146 13.3 L	205017	161 13.7 L	*211570*	135 9.9 Ah	T PEG
151 13.5 Pt	145 12.4 L	Z CAP	100 6.5 Ht	142 9.9 Ah	220412
156 13.6 L	151 12.4 Pt	*210516*	116 6.4 Ht	144 9.9 Ah	132 10.3 L
	156 12.6 L	174 10.7 Pt	131 5.8 Ht	145 9.9 Ah	151 10.8 L

Variable Star Observations Received During July and August, 1930.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
T Peg	S Lac	R Peg	S Peg	R Aqr	R Cas
220412	222439	230110	231508	*233815*	235350
169 11.6 L	181 11.1 L	159 8.0 Ah	155 9.8 Ah	131 7.7 L	135 10.0 Ah
180 12.5 L	184 11.4 Br	160 8.2 Ah	175 10.8 L	147 7.9 Ht	147 10.4 Fd
184 12.5 Br	R Ind	180 8.0 Pt	180 11.1 Pt	151 7.8 L	148 9.7 Fd
Y Peg	*222867*	181 8.2 Gy	191 11.2 Br	152 8.0 Pt	156 9.7 Fd
220613	099 13.6 Dr	184 8.0 Br	V Phe	165 7.8 L	185 11.6 Br
184[13.7 Br	146 13.1 Bl	V Cas	*232746*	172 8.1 Tf	Z Peg
191[13.7 Br	147 12.5 Ht	230759	099 12.8 Dr	175 8.1 L	235525
RS Peg	153 12.8 Dr	142 9.6 Fd	147 10.3 Ht	180 8.3 Pt	130 9.2 Lj
220714	155 12.1 Bl	144 9.3 Fd	153 9.9 Dr	180 8.4 Tf	135 9.0 L
132 11.4 L	T Tuc	147 9.5 Fd	160 9.7 Dr	182 8.3 Ma	142 9.5 Lj
150 9.7 L	*223462*	148 9.5 Fd	Z And	184 8.4 L	145 9.5 Lj
152 9.8 Pt	099 10.7 Dr	149 9.8 Fd	232848	187 8.4 Tf	147 9.5 Lj
169 9.3 L	100 10.7 Ht	152 11.6 Pt	152 10.1 Pt	Z Cas	151 9.3 L
180 9.6 Pt	147 8.1 Ht	155 9.6 Fd	180 10.3 Pt	*233956*	152 9.5 Pt
181 9.4 L	153 8.1 Dr	156 9.5 Fd	ST And	135 13.6 L	157 9.9 Lj
191 10.3 Br	156 8.2 Sm	180 11.0 Pt	*233335*	151[13.4 L	158 10.0 Lj
R PsA	160 8.0 Dr	184 10.8 Lj	121 8.9 Ch	184[13.1 Br	161 10.2 Lj
221230	R Lac	184 10.6 Br	130 8.9 Lj	191[14.2 Br	175 10.4 L
099 13.5 Dr	223841	189 10.6 Lj	133 8.9 Lj	TX Cep	176 10.4 Lj
153 11.3 Dr	151 14.0 L	W Peg	142 8.7 Lj	*234875*	177 10.5 Lj
S Gru	176 13.2 L	*231425*	145 8.8 Lj	184 13.2 Br	180 11.1 Pt
221948	184 12.5 Br	135 8.7 L	147 8.9 Lj	191 12.9 Br	183 10.9 Lj
099 11.9 Dr	R Gru	151 8.4 L	147 8.4 Fd	RR Cas	189 11.2 Lj
100 12.3 Ht	*224247*	155 8.6 Fd	149 8.4 Fd	235053	191 11.0 Br
147 8.1 Ht	100 10.1 Ht	156 8.6 Fd	152 8.6 Pt	156 11.0 Bn	Y Cas
153 7.9 Dr	RW Peg	169 8.4 L	153 8.5 Fd	177 11.4 Bn	235855
RV Peg	225914	170 8.8 Bw	153 9.0 Lj	184 11.3 Br	135 12.5 L
222129	135 11.0 L	172 8.6 Jo	155 8.6 Fd	205 12.7 Bn	151 12.7 L
135 13.2 L	148 11.9 L	175 8.5 Jo	156 8.4 Fd	R Phe	176 12.8 L
151 13.6 L	157 12.7 L	180 8.3 Jo	157 9.0 Lj	*235150*	191 14.2 Br
181 13.7 L	175 13.3 L	181 8.5 L	158 9.0 Lj	099 11.0 Dr	SV And
184 13.6 Br	184 14.0 Br	183 8.0 Jo	161 9.0 Lj	160 10.6 Dr	235939
S Lac	R Peg	192 9.4 Dg	176 9.0 Lj	R Tuc	152 9.4 Pt
222439	*230110*	192 9.4 Fd	177 9.0 Lj	*235265*	180 11.6 Pt
135 9.2 L	144 8.5 Ah	S Peg	180 8.7 Pt	099 14.0 Dr	191 11.8 Br
151 9.7 L	145 8.6 Ah	*231508*	183 9.2 Lj	147[13.3 Ht	
152 10.3 Pt	147 8.7 Ah	135 8.7 L	188 9.2 Lj	160[13.6 Dr	
169 10.6 L	147 8.6 Ah	144 9.3 Ah	189 9.1 Lj		
180 10.8 Pt	152 8.0 Pt	151 9.1 L	189 9.4 Dg		
	155 8.2 Ah	152 9.5 Pt	192 9.0 Dg		
	158 8.2 Ah		192 9.0 Fd		

Rapidly Varying Irregular Variables.

Star J.D.	Est.Obs.	J.D.	Est.Obs.	Star J.D.	Est.Obs.	J.D.	Est.Obs.
005940 RX Andromedae—				060547 SS Aurigae—			
6155.9	13.0 Pt	6183.7	11.3 Pt	6164.6	10.9 L	6181.6[	12.4 L
6159.8	11.5 Pt	6184.9	11.6 Br	6165.6	11.0 L	6182.6[	12.4 L
6157.8	11.5 Pt	6186.7	12.4 Pt	6166.6	11.1 L	6183.6[	13.3 L
6174.7[	11.7 Pt	6187.8	13.1 Pt	6169.6[	11.6 L	6184.6[	12.4 L
6176.7[	11.5 Pt	6188.8	13.3 Pt	6180.8[	12.6 Pt		
6180.7	13.0 Pt	6191.8	13.0 Br	074922 U Geminorum—			
6182.8	11.8 Pt	6200.7[	12.0 Pt	6114.1[	13.3 Ch	6140.3[	11.4 L
060547 SS Aurigae—				081473 Z Camelopardalis—			
6101.1[	12.5 Ch	6160.6	11.0 L	6099.1	11.3 Ch	6138.5	11.6 L
6139.3[	10.8 L	6161.6	10.8 L	6131.6	11.4 L	6139.4	11.6 L
6140.3[	11.0 L	6162.6	10.8 L	6135.5	11.5 L	6140.3	11.4 L
6160.1	11.0 L	6163.6	10.8 L	6137.6	11.6 L	6142.3	11.3 L

VARIABLE STAR OBSERVATIONS RECEIVED DURING JULY AND AUGUST, 1930.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.	Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
081473 Z CAMELOPARDALIS—							213843 SS CYGNI—						
	6143.4	11.4	L	6165.3	12.7	L		6144.4	8.4	Lj	6158.5	11.6	L
	6146.3	12.3	L	6165.6	12.8	L		6144.6	8.5	Jo	6158.5	11.8	Lj
	6148.3	12.6	L	6166.6	12.9	L		6144.7	8.8	Pt	6158.6	11.5	L
	6150.4	12.8	L	6169.3	12.8	L		6144.7	8.5	Bc	6158.7	11.5	Bc
	6151.3	13.0	L	6170.3	13.3	L		6144.7	8.3	Fd	6158.7	11.7	Pt
	6152.6	13.3	L	6172.4	13.1	L		6145.4	8.5	Lj	6159.4	11.8	Ah
	6153.3	12.9	L	6172.6	12.8	L		6145.4	8.7	Ah	6159.6	11.6	L
	6154.4	13.0	L	6173.3	13.0	L		6145.6	8.7	L	6159.7	11.5	Bc
	6155.3	13.0	L	6174.3	12.9	L		6145.9	9.9	Ma	6160.4	11.8	Ah
	6156.3	12.8	L	6175.3	13.3	L		6146.4	8.7	Lj	6160.6	11.7	L
	6157.5	10.7	L	6176.3	12.8	L		6146.4	8.7	Ah	6160.6	12.0	Jo
	6158.3	10.7	L	6177.3	11.6	L		6146.6	8.8	L	6160.7	11.7	Pt
	6159.3	11.0	L	6177.6	11.2	L		6146.7	9.0	Pt	6161.4	11.9	Lj
	6160.3	11.1	L	6179.3	10.7	L		6146.7	8.6	Bc	6161.6	11.6	L
	6160.5	11.0	L	6180.3	10.7	L		6147.4	9.2	Lj	6161.8	11.6	Br
	6161.6	11.4	L	6181.3	11.1	L		6147.4	8.9	Ah	6161.9	11.7	Pt
	6162.6	11.6	L	6182.3	11.2	L		6147.6	8.6	Bz	6162.6	11.6	L
	6163.3	11.5	L	6183.3	11.4	L		6147.6	8.4	Gb	6162.7	11.1	Ma
	6163.6	11.8	L	6183.6	11.8	L		6147.7	8.6	Bc	6162.8	11.5	Br
	6164.6	12.6	L	6184.6	12.0	L		6147.7	9.4	Pt	6163.6	11.5	L
094512 χ LEONIS—								6147.7	8.4	Fd	6164.7	11.5	Bc
	6138.8	13.2	L	6142.3	12.3	L		6148.4	9.2	Be	6165.6	11.5	L
	6139.3	12.2	L	6146.3	12.3	L		6148.5	9.1	L	6165.7	12.0	Fd
	6141.3	12.0	L	6156.3	12.3	L		6148.6	8.8	Jo	6165.7	12.0	Bc
202946 SZ CYGNI—								6148.7	9.6	Bc	6167.7	11.3	Bc
	6140.7	9.5	Pt	6174.7	9.0	Pt		6148.7	8.5	Fd	6169.6	11.4	Sd
	6141.7	9.1	Pt	6175.7	9.1	Pt		6148.7	9.3	Pt	6169.6	11.5	Mg
	6144.7	9.2	Pt	6176.7	9.2	Pt		6149.7	9.8	Bc	6169.6	11.4	L
	6146.7	9.0	Pt	6180.7	9.6	Pt		6149.8	9.8	Fd	6170.8	11.0	Ma
	6147.7	9.4	Pt	6182.8	9.6	Pt		6150.5	9.6	L	6170.8	11.4	Br
	6148.7	9.5	Pt	6183.7	9.6	Pt		6150.5	9.8	Ah	6172.4	11.7	Lj
	6151.7	9.6	Pt	6186.7	8.9	Pt		6151.5	10.2	L	6172.6	10.7	Jo
	6152.7	9.5	Pt	6187.8	9.0	Pt		6151.7	10.3	Bc	6172.6	11.6	L
	6153.7	9.5	Pt	6188.8	9.0	Pt		6151.7	10.5	Pt	6172.7	11.3	Mg
	6155.7	9.5	Pt	6189.7	9.0	Pt		6151.7	10.7	Fd	6172.7	11.3	Bc
	6156.8	9.0	Pt	6190.7	9.0	Pt		6152.5	10.5	L	6172.7	11.6	Pt
	6157.8	8.8	Pt	6191.8	9.0	Pt		6152.7	10.9	Bc	6173.4	11.5	L
	6158.7	8.9	Pt	6195.7	9.4	Pt		6152.7	10.8	Pt	6173.6	11.5	Jo
	6160.7	9.1	Pt	6197.7	9.5	Pt		6153.4	11.0	Lj	6173.7	11.3	Bc
	6161.9	9.2	Pt	6199.7	9.5	Pt		6153.2	10.8	Ch	6173.7	11.7	Pt
	6172.7	8.8	Pt	6200.7	9.2	Pt		6153.6	11.3	Jo	6173.7	11.5	Gb
	6173.7	8.9	Pt					6153.6	10.7	L	6173.9	11.1	Ma
213843 SS CYGNI—								6153.7	11.5	Pt	6174.7	11.7	Pt
	6121.4	11.5	Ch	6139.4	8.2	Ah		6153.7	11.5	Fd	6174.5	11.7	Md
	6130.4	11.3	Lj	6139.6	8.5	L		6154.6	11.0	L	6175.6	11.8	L
	6130.5	11.2	Lj	6139.7	8.4	Bc		6155.4	11.2	Ah	6175.7	11.7	Pt
	6130.5	11.3	Lj	6140.5	8.3	Ah		6155.6	11.5	Jo	6176.5	11.9	Lj
	6131.6	11.0	L	6140.6	8.5	L		6155.6	11.5	L	6176.7	11.7	Pt
	6132.4	11.7	Lj	6140.7	8.3	Pt		6155.7	11.6	Pt	6177.4	11.8	Lj
	6132.6	11.3	L	6141.4	8.7	L		6155.7	12.0	Fd	6177.4	11.5	L
	6133.4	11.8	Lj	6141.4	8.4	Ah		6155.7	11.5	Bc	6177.7	11.8	Bc
	6134.3	11.8	Ch	6141.7	8.3	Pt		6156.6	11.5	L	6177.7	11.9	Fd
	6134.4	11.7	Lj	6142.4	8.3	Ah		6156.7	11.7	Pt	6177.7	11.7	Br
	6134.6	11.4	L	6142.5	8.4	Lj		6156.7	12.0	Fd	6178.6	11.1	Lj
	6135.6	11.4	L	6142.5	8.5	L		6157.4	11.8	Lj	6179.6	10.9	L
	6137.6	10.3	L	6142.7	8.2	Fd		6157.5	11.5	L	6179.7	10.2	Bc
	6138.5	8.5	Ah	6142.9	8.3	Br		6157.5	11.6	Pt	6180.4	10.2	L
	6138.6	8.7	L	6143.4	8.7	L		6157.9	11.6	Wk	6180.6	10.0	L
	6138.7	8.5	Bc	6143.7	8.5	Bc		6158.4	11.6	Ah	6180.6	10.2	Bc

VARIABLE STAR OBSERVATIONS RECEIVED DURING JULY AND AUGUST, 1930.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.	Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
213843 SS CYGNI—							213843 SS CYGNI—						
	6180.6	11.0	Jo	6183.7	9.5	Fe		6189.6	9.1	Lj	6196.8	11.9	Br
	6180.7	10.5	Gb	6183.8	9.5	Ma		6189.6	9.5	Df	6197.7	11.7	Pt
	6180.7	10.2	Pt	6184.3	9.3	L		6189.7	9.3	Ld	6199.7	11.7	Pt
	6180.8	10.0	Mg	6184.6	9.4	L		6189.7	9.2	Pt	6199.9	12.1	Ba
	6180.8	10.0	Lg	6184.6	9.7	Bc		6190.7	9.8	Pt	6200.6	11.6	Mg
	6181.3	9.4	L	6184.6	9.8	Lj		6191.8	10.3	Pt	6200.7	11.7	Pt
	6181.6	9.8	L	6184.8	9.8	Br		6191.8	9.6	Ma	6203.6	12.0	Bc
	6182.3	9.7	L	6185.0	9.5	Br		6191.8	9.7	Br	6207.6	11.9	Bc
	6182.6	9.7	L	6186.7	9.3	Pt		6192.6	10.3	Bc	6208.6	11.8	Bc
	6182.6	9.7	Bc	6186.7	8.6	Gb		6193.6	10.2	Bc	6211.6	12.0	Bc
	6182.8	10.2	Pt	6187.6	8.7	Jo		6193.6	10.5	Fd	6213.6	12.0	Bc
	6182.9	9.8	Ma	6187.8	9.0	Pt		6193.6	10.5	Gb	6215.6	12.0	Bc
	6183.4	9.7	L	6188.6	9.0	Lj		6193.8	9.7	Fd	6216.6	11.5	E
	6183.5	9.9	Lj	6188.8	9.0	Pt		6194.8	10.6	Br	6216.6	11.6	C
	6183.6	9.7	Lj	6188.8	9.2	Br		6195.6	11.1	Ma	6217.6	11.9	E
	6183.6	10.0	Jo	6188.9	8.9	Ba		6195.7	11.7	Pt	6217.6	11.9	C
	6183.7	10.2	Pt	6188.9	9.1	Ma		6195.7	11.2	Fd	6219.6	12.0	Bc
	6183.7	9.7	Bc	6189.6	9.2	Gb							

SUMMARY OF OBSERVATIONS FOR JULY AND AUGUST, 1930.

Observer	Initial	Vars.	Observations	Observer	Initial	Vars.	Observations
Ahnert	Ah	32	285	Haas	HS	9	37
Baldwin	Bl	81	136	Houghton	Ht	83	242
Bancroft	Ba	18	19	Jones	Jo	40	251
Benini	Be	4	12	Kendall	Kl	3	3
Bigelow	Bw	19	33	Lacchini	L	174	784
Boutell	BL	9	55	Lehrkind	Ld	3	3
Brocchi	Br	91	110	Leiner	Lj	15	208
Brown, A. N.	Bn	2	6	Logan	Lg	14	32
Buckstaff	Bc	25	122	Marsh	Ma	27	73
Bussewitz	Bz	2	2	McLeod	Mc	3	8
Campbell	C	3	4	Meek	Me	5	8
Chandra	Ch	106	186	Millard	Md	21	28
Darling	Dg	9	25	Monnig	Mg	32	60
Dartayet	Dr	93	255	Peltier	Pt	173	497
Dornfield	Df	4	6	Sanders	Sd	10	12
Elmer	E	2	3	Smith, F. W.	Sf	10	27
Ensor	En	67	237	Smith, W. H.	Sm	57	146
Ferris	Fe	5	5	Taffara	Tf	8	25
Ford	Fd	54	224	Watkins	Wk	11	11
Gaebler	Gb	9	32	Webb	Wd	11	55
Gregory	Gy	10	20				
				Totals		41	416	4287

them entirely new to the field, others who have, for some reason or another, been inactive for some time: Messrs. Bancroft, Bussewitz, Darling, Dornfield, Elmer, Ferris, Kendall, Lehrkind, Meek, and Watkins. An Association 5-inch telescope outfit is being loaned to Mr. Gregory of Auburn, N. Y., with the hope that his already valuable efforts made with a 2-inch glass may be still more augmented.

Attention is called to the 19th Annual Meeting of the Association to be held at the Harvard College Observatory, Cambridge, Massachusetts, on October 18.

LEON CAMPBELL, Recording Secretary.

September 9, 1930.

METEOR NOTES

By CHARLES P. OLIVIER.

During the first part of August, by the cordial assistance of *Science Service* and the *Associated Press*, a request for observations of the Perseids, for the dates of expected maximum frequency, was widely circulated. The writer has already received clippings from hundreds of newspapers, showing what a wide publicity was secured. Most of these papers did not add very much due to local editing, therefore there were comparatively few ridiculous misstatements, while the public at large had their interest in astronomical matters considerably stirred up. The result was that, despite the strong moonlight which made the shower far inferior to that of the average year, reports from all parts of the country have poured in from persons whose interest was aroused for the first time. Besides these many of our members had good success. We can hardly be wrong then in affirming that more observing was done in America on the Perseids in 1930 than in any previous year. Largely as a result of this campaign, the following new members have joined the A.M.S. and are hereby welcomed to our ranks:

R. H. Wilson, Swarthmore College, Swarthmore, Pennsylvania.
Ambrose Burns, Fort Worth, Texas.
James E. McKee, 206 Gambier Street, Mt. Vernon, Ohio.
Ralph Menke, Hebron, Nebraska.
John H. Hett, 17 Oriole Avenue, Bronxville, New York.
E. J. Huscher, Corporal, 11th Engineers, Corozal, C. Z.
R. H. Baker, 134 Frazier Street, State College, Pennsylvania.
Frank Almandoz, 440 Pacific Street, Brooklyn, New York.
Miss Marian McVictor, 816 Ocean Avenue, Ocean City, New Jersey.
David L. McVictor, 816 Ocean Avenue, Ocean City, New Jersey.
Carlton Abernathy, P. O. Box 584, Clearwater, Florida.
A. H. Yanousky, 1953 North Patton Street, Philadelphia, Pennsylvania.
G. D. Grotto, 110 Gesler Street, Providence, Rhode Island.

Due to the immense amount of data at hand, it is quite impossible to publish all of it in the Meteor Notes for this month. Our old members therefore will gladly see the results of non-members given precedence, while their own will await further study before publication. Some names appearing in the table below will also be found among those who have just joined the A.M.S., but had not done so when their work was sent in.

To all contributors to the success of the August campaign our best thanks are due. It is most regrettable that the best observations cannot be given here in fuller detail. Consolation may be had in the certainty that such observations will be used in subsequent publications, where their makers will receive proper credit, as is their due. It would be unjust, however, not to mention a few persons who organized large groups of observers and gave them the needed instructions. These were: Mrs. F. W. Michaux, Miss A. W. Wilcox, Dr. P. R. Burch, R. T. Daniels, E. H. Graham, and G. B. Hussey. The names of about thirty other persons who sent in reports on isolated meteors, but which were of no value for the determination of rates, have been omitted. This does not imply that many of these reports will not be used for other purposes later.

Near Philadelphia, an organized effort was made by the writer to secure heights by duplicate observations. Those who took part are all members of the A.M.S. One of this group, F. W. Smith, is now voluntarily engaged in the calcu-

Observer and Station	Time W	1930 Aug.	Began	Ended	Total	Meteors	Fac.	Rate	Corrected Rate	Remarks
Adams, H. L., Lucerne, California	8h	4			?	40±	1.0	?		During night in N.E.
Campbell, Prof. L., Concord, N. H.	4	10	13:45	16:30	75	21		17		
Ramee, H. P., West Newton, Mass.		9	10:00	11:14	74	4		3		
Ramee, H. P., West Newton, Mass.		10	10:25	11:16	49	5		6		
Ramee, H. P., West Newton, Mass.		11	9:00	9:43	43	10		14		
Harbutt, Rev. R. G., Penney Farms, Fla.		10	11:30	13:00	90	6	0.3	4	13	
Grotto, G. D., Providence, Rhode Island		10	13:10	13:30	20	4		12		Observed in city.
Grotto, G. D., Providence, Rhode Island		11	10:	11:	60	7		7		
Grotto, G. D., Providence, Rhode Island		12	15:20	15:57	37	7		11		
Michaux, Mrs. F. W., Wichita Falls, Texas	6	11	9:00	15:00	360	63	0.2			6 to 2 obs.; Camp Fire Girls.
Daniel, R. T., Asheville, N. C.	5	11	8:00	17:00	540	238	0.5			3 to 4 obs.; 3 High School boys.
Daniel, R. T., Asheville, N. C.	5	12	8:00	17:00	540	81	0.4			2 to 4 obs. Strong max. 15h5 Aug. 11; max. 9h Aug. 12, another at 16h, low rate between.
Milerand, P. M., Off Lower California	8	11	12:	15:	180	30+		10+		At sea.
Hett, J. H., South Norwalk, Conn.		11	9:00	15:30	390	90	0.3	14	47	Strong max. 15h
Dubois, Edward, Hillside, New Jersey	5	11	14:00	16:15	135	21	0.3	9	31	
Heyden, A. J., Little Rock, Arkansas	6	11	10:45	13:45	180	9	0.4	3	8	All plotted.
Lyons, R. F., Big Springs, Texas	6	11	10:00	12:30	150	50	0.4	20	50	
Gale, Mrs. B. L., Wahant, Massachusetts		11	8:40	10:51	131	27	0.4			3 observers.
Gale, Mrs. B. L., Wahant, Massachusetts		12	8:40	11:40	180	28	0.3			3 observers.
Lopspeich, E. S., Blue Ridge, N. C.	5	11	10:15	16:00	345	145	0.5			2 observers, strong max. 15h
Jewett, Miss M. L., Grandview, Tennessee	6	11	12:00	14:00	120	29	0.4	14	36	At 14h increasing rapidly.
Baker, S. R., York, Pennsylvania		11	11:00	13:55	175	30		10		
Baker, S. R., York, Pennsylvania		12	11:00	13:30	150	20		8		
Zaehringer, Miss H., Philadelphia, Pa.		11	14:00	15:00	80	19	0.3	14	48	
Barnes, Mrs. H. B., Stonington, Conn.	5	11	12:30	13:35	65	18		17		
Roper, E. E., Cambridge, Massachusetts	5	11	10:00	11:00	60	6	0.2	6	30	3 more later.
St. Amour, J. A., Keyport, New Jersey		11	11:50	14:10	140	23		10		
Baker, F. C., & Jecinck, Chas., Bloomfield, N. J.		11	8:30	13:15		81	0.3			2 observers.
Jecinck, Chas., Bloomfield, New Jersey		12	9:00	11:50	170	49	0.4			2 observers.
Bonitz, Miss E. M., Windham, N. H.		11	9:	11:	120	27				2(?) observers.
Graham, E. H., Buck Hill Falls, Pa.		11	8:30	13:00	270	81				3+ observers.
Ciminelli, P., Leetonia, Ohio		11	11:00	12:04	64	19		18		
Esposito, Geo., & Virgillo, S., Fords, N. J.	4	11	11:50	18:00	370	28	0.3			2 observers.
Dotterer, J. E., Lancaster, Pennsylvania	5	11	15:18	16:06	48	22		28		

Observer and Station	Time W	1930 Aug.	Began	Ended	Total	Meteors	Fac.	Corrected Rate		Remarks
Dotterer, J. E., Lancaster, Pennsylvania	5	12	15:26	16:00	34	5		9		1 curved path.
Hussey, G. B., Weaverville, N. C.	5	11	8:	12:	240	27	0.4			With others.
Hussey, G. B., Weaverville, N. C.			12:00	17:00	300	78	0.3			4 obs.; strong max. 15h.
Benway, Miss H. L., Lowell, Massachusetts		11	10:30	12:30	120	17				2 obs.; D.S.T. used.
Gorman, F. J., Wellesley Farms, Mass.		11	9:30	10:30	60	8	0.4	8	20	1 bright.
Clyde, Mrs. S. D., Rehoboth Beach, Delaware		11	13:45	16:00	135	37	0.3			6 observers.
Evans, M. L., Philadelphia, Pennsylvania		11	14:00	15:30	90	16	0.4	11		15 Perseids; plotted.
Baker, R. F., State College, Pennsylvania		11	14:02	15:02	60	21	0.4	21	52	
Baker, R. F., State College, Pennsylvania		12	14:09	15:09	60	29	0.4	29	72	
Bodtke, Dick, Ocean Gate, New Jersey		11	12:30	13:30	60	16	0.4	16	40	
Sherred, L. E., Grand Rapids, Michigan		11	9:50	14:20	270	34	0.4	8	19	32 Perseids; 1 stationary.
Almandoz, Frank, Brooklyn, New York		11	11:50	12:50	60	7		7		Plotted; in city.
Parker, L. C., Prout's Neck, Maine	5	11	12:19	13:19	60	27	0.3	27	90	6 trains noted; Aurora in N.
Werntz, F. C., Philadelphia, Pennsylvania		11				49	0.3			Strong max. 15h.
McVictor, Miss M. & David, Ocean City, N. J.		11	12:05	15:20	195	38	0.2			2 observers; plotted.
McVictor, David, Ocean City, New Jersey		12	12:05	16:02	237	70	0.4			2 observers; plotted.
Miss ——, Waynesboro, Pennsylvania		11	15:00	16:00	60	12	0.3	12	40	
Stauffer, H. M., Philadelphia, Pennsylvania		11	10:00	11:33	93	26	0.3			2 observers.
Caley, Fred, Frankford, Pennsylvania	5	11	12:00	14:00	120	24		12		
Donovan, James, South Bronx, New York	5	11	11:00	12:15	75	15	0.3	12	40	
Lecky, Robert, Philadelphia, Pennsylvania	5	11	12:45	13:45	60	5	0.3	5	17	
Cook, George F., Franklin, Massachusetts		11	10:12	12:02	110	23	0.4	13	31	
Hardman, Rev. S., Riverside, New Jersey		11	9:30	11:00	90	13	0.3	9	30	
Hardman, Rev. S., Riverside, New Jersey		12	9:20	11:00	100	16	0.3	10	32	
Goldstein, Harry, Chattanooga, Tennessee	6	11	7:45	12:00	255	96±	0.4	23±	56±	32 plotted; "twice as many faint"
Blakeslee, H. W., Babylon, New York		11	12:15	13:00	45	15	0.4	20	50	
Wilcox, Miss A. W., Meredith, N. H.		11	8:45	9:30	45	26	0.5			9 observers.
Wilcox, Miss A. W., Meredith, N. H.			9:30	13:45	60	16	0.4	16	40	1 observer.
Wilcox, Miss A. W., Meredith, N. H.		12	8:45	9:55	70	52	0.5			15-18 observers.
Wilcox, Miss A. W., Meredith, N. H.			10:00	11:00	60	18	0.4	18	45	1 observer.
Coles, Mrs. W. S.	5	11	14:							"Too many to count."
Aber, Capt. L., Palo Alto, California	8	11	8:	9:30	90	7	0.2	5	23	Also 7 casuals Aug. 11 and 12.
Darby, R. A., Somerville, New Jersey	5	11	14:00	16:15	135	40	0.4	36	89	
Rossin, E. T., Red Bank, New Jersey		11	14:45	16:45	120	64	0.4	32	80	
Rossin, E. T., Red Bank, New Jersey		12	14:30	16:45	135	49	0.4	22	54	
Robinson, R. I., Yonkers, New York	5	11	9:00	11:00	120	25	0.4			2 observers.

Observer and Station	Time 1930 W	Aug.	Began	Ended	Total	Meteors	Fac.	Rate	Corrected Rate	Remarks
Pittsford, Mrs. E. M., Delevan, Illinois	6	12					0.4	12		
Wright, Mrs. H. E., Castle Point, N. Y.		12	12:	15:30	210	93	0.3	27	89	Strong max. 15^h.
Burch, Dr. P. R., East Radford, Virginia	5	11	10:20	17:00	71	14	0.4	12	30	
Burch, Dr. P. R., East Radford, Virginia	5	12	8:50	15:07	105	18	0.5			
Students at State Col., East Radford, Va.	5	11	9:	11:30	150		0.4	7	18	Mean of 2 observers.
Students at State Col., East Radford, Va.	5	12	8:30	12:00	210		0.3	6	20	Mean of 5 observers.
Gunning, J. C., Lone Wolf, Oklahoma	6	12	8:30	10:30	120	17	0.5	8	17	Plotted.
Collins, H. F., Montclair, New Jersey		12	13:00	15:30	120	45	0.4	22	57	
Prest, C. A., Bellrica, Massachusetts		?	11:	15:00	240	15	0.4	4	9	
Arnold, Dean, Kansas City, Kansas	6	13	12:30	13:30	60	42		42		
Phillips, W. M., San Francisco, California	8	14	13:15	14:30	75	2		2		
REPORTED THROUGH HARVARD COLLEGE OBSERVATORY.										
Mackierman, D. S., Stoughton, Massachusetts		11	11:00	15:30	270	113	0.4	25	63	Max. at 15+^{h}.
Mackierman, D. S., Stoughton, Massachusetts		12	11:00	15:30	270	105	0.4	23	58	Max. at 11^{h}5 & 15+^{h}; poor between
Dow, Miss E., Chesterfield, Massachusetts		11	12:00	14:00	120	47	0.4	24	59	
Sine, Dr. A. H., Cambridge, Massachusetts		11	10:41	11:37	56	8		9		
Sill, J. D., Winthrop, Massachusetts		11	9:10	9:33		4				
Morris, Miss E. C. H., Walpole, Massachusetts		11	9:20	12:00	120	20		10		
Morris, Miss E. C. H., Walpole, Massachusetts		12	9:30	10:35	65	13		12		
Wood, F. L., Nantucket Beach, Massachusetts		11	15:15	16:30	75	44	0.5	35	70	
Wood, F. L., Nantucket Beach, Massachusetts		12	11:15	11:45	30	11	0.5	22	44	
H. H. D., Beverly, Massachusetts		11	9:20	10:00	40	6	0.3	9	30	
Dimock, R. V., Crystal Lake, N. H.		11	10:00	10:30	30	14				2 observers.
Dimock, R. V., Crystal Lake, N. H.		12	10:30	11:00	30	31				2 observers.
Cummings, S. B., Norway, Maine		12	8:16	9:34	78	11	0.4			4 also on Aug. 11.
Senior, Mrs. E. J., Bristol, New Hampshire		12	8:45	10:30	105	23				8 bright.

NOTE: It will be understood that counts only were made, unless the contrary is stated in the "Remarks" column. Most observers sent in tables with data on the brighter meteors and much other information. There is uncertainty in very many cases as to whether Standard Time or Daylight Time was used by observers in the eastern states. For these cases Column 3 is left blank. The writer has reduced all hours given to the astronomical date, beginning with noon, i.e. the old reckoning. Due to moonlight, the factor can never be over 0.5, and on an average was 0.4.

lations. Later the results will doubtless form the basis for a separate article.

A general discussion of all the results cannot be made until the data from the A.M.S. members can also be tabulated and published, which we hope to do next month. Meantime Bulletin No. 11, containing the revised membership list, is in press and should soon be ready for distribution. The writer's new book "Comets," a sequel to "Meteors" and containing considerable new information on the latter, has now appeared.

The work of the A.M.S. is so much more valuable and the results so numerous that it will be necessary to add a special member to the staff of the Flower Observatory to attend to the routine reductions and correspondence. How soon the funds can be found for this is problematical. Meantime all three of our assistants are at work on special problems in connection with meteors, and the writer gives all possible time to keeping up the general work of the Society. If members are ever disappointed at long delays in the appearance of their work in print, these facts must be remembered.

Flower Observatory, Upper Darby, Pennsylvania, 1930 September 19.

Definitions in Meteoric Astronomy

The terms *meteor* and *meteorite* are used loosely so often that it is difficult, without careful investigation, to decide on the best usage. *Meteor* may refer to a small solid body in interplanetary space, to the luminous phenomena produced when such a body enters the earth's atmosphere, or to a solid body dropped on the surface of the earth by such a visitor from space. The term *meteorite* may refer to—first, one of the numerous small solid bodies in interplanetary space; second, to a meteor, especially to one dropping stones; third, to a body dropped on the surface of the earth by a meteor; or fourth, to all of the bodies, taken collectively, dropped on the earth by a great meteor.

For the small solid body in interplanetary space we use the term *meteoroid*. If it falls into the earth's atmosphere we see a *meteor*. Meteors no brighter than Venus, the brightest star or planet, are *shooting stars*. More brilliant objects are *fireballs*. If accompanied by explosions it is a *detonating meteor*. If the remnants of a meteor reach the surface of the earth, the solid bodies dropped are *meteorites*, and such meteors are *stone-producing meteors*. To make more clear the use of these terms we quote from Webster's *Dictionary*, from Young's *General Astronomy*, from H. A. Newton, well known to all students of meteoric astronomy, from Flight's *A Chapter in the History of Meteorites*, from Newcomb's *Popular Astronomy*, from Olivier's *Meteors*, from Farrington's *Meteorites*, and from a recent article in Popular Astronomy. The italics are ours.

Webster—*meteor*. A transient luminous body seen moving rapidly through the atmosphere, esp. in the higher regions, . . . also, loosely, *a meteoroid*.

meteorite. A stony or metallic body that has fallen to the earth from outer space; an aerolite; loosely a *meteor* or *meteoroid*.

meteoroid. One of the countless small solid bodies in the solar system which become meteors on entering the earth's atmosphere.

Young—Occasionally bodies fall on the earth from the sky,—masses of stone or iron which sometimes weigh several tons. During its flight through the sky such a body is called a *meteor*, and the pieces which fall from it are called *meteorites*, . . .

Newton—There appears to be no clear line of distinction between the *stone-producing* and the *detonating meteors*, nor between those heard to explode and those seen to break in pieces, nor between these and the simple *fireballs*, nor between the fireball and the faintest *shooting star*.

There is in the average to every portion of space equal to a cube whose edge

is about 210 miles one *meteoroid* large enough to make a shooting star bright enough to be visible to the naked eye.

One of the Hessle *meteorites* in the Stockholm museum weighs less than one grain. Many of the Emmet county *meteorites*, (May 10, 1879), are not much larger, though the largest specimen of that fall weighs nearly 500 pounds.

FLIGHT—He states that the different fragments into which the *meteor* broke up were distinctly visible, . . . One of the *meteorites* fell close to a man who had gone out into the jungle . . . and frightened him so much that he hardly knew what occurred, and was under the impression that the stone pursued him for two hours.

NEWCOMB—We know that the *meteoroids* which produce the November shower already described move in a direction nearly opposite that of the earth with a velocity of 26 miles per second, so that the relative velocity with which the meteoroids meet our atmosphere is 44 miles per second.

OLIVIER—In general we will consider a meteor as a *"shooting star"* which may vary in brightness from the faintest we can see to a body perhaps as bright as Saturn or Jupiter. *Fireballs* generally are considered to be at least as bright as Jupiter or Venus . . . .

FARRINGTON—Occasionally the passage of a *meteor* producing *meteorites* may be observed over an area of thousands of square miles.

Soon after the first sound a number of *meteorites* fell over an area a mile and a half in length and a half mile in breadth. The largest of these weighed 38 kilos (84 pounds).

The form is evidently due to the greater exposure of the forward corners of the falling *meteorite* to the heat and friction of the atmosphere.

POPULAR ASTRONOMY, Vol. 37, No. 9—The bright meteor itself came low enough (about 24 miles is our figure) that it seems possible *meteorites* might have fallen from there to the surface of the earth. *Meteorites* fall through our lower atmosphere as dark bodies, not as balls of fire, and as this fall occurred at night they would not be seen.

C. C. WYLIE.

University of Iowa, September 16, 1930.

The Dharmsala, Dhurmsala, or Dhurmsalla Meteorites

This fall, which occurred in the Kangra district, Punjab, India, at about 2:15 P.M. on the afternoon of July 14, 1860, has been since that time the standard illustration of meteorites found cold. The following quotations illustrate the story as given.

The cold of the fragments that fell was so intense as to benumb the hands of the coolies who picked them up and who were obliged in consequence of their coldness instantly to drop them. HAUGHTON, 1866.

It appears that soon after their fall, the stones were intensely cold. KIRKWOOD, 1867.

The stones which fell at Dhurmsala in India (1860 July 14) are stated to have been so cold that they could not be held in the hand. FLIGHT, 1887.

It is recorded that one of the large fragments of the Dhurmsala (India) meteorite, which fell in 1860, was found in moist earth half an hour or so after the fall, *coated with ice*. YOUNG, 1893.

The Dhurmsala stone is said to have been intensely cold when picked up. OLIVIER, 1925.

The Dhurmsala stone of 1860 is stated to have been intensely cold when picked up immediately after falling, frost forming on its surface. MERRILL, 1928.

In spite of the regularity with which this report is quoted, Flight tells us that the only foundation for this was the statement of the natives that the meteorite came "from the abode of snow." This, which had been interpreted as meaning that the stones were quite cold when found, was, he writes, a native phrase meaning "from a northerly direction," the direction of the snow covered Himalaya mountains. On this interpretation, the story of the natives may have meant

that the stones had fallen from a northerly direction, not that they had been found very cold. Some reports suggest that certain of the native deities were supposed to reside in the Himalayas, and because of the (to the natives) miraculous nature of the fall of the stones, it was assumed they had been thrown from those mountains. It would be interesting to have the original records on this fall looked into as far as possible. As it stands now, the extreme cold is not nearly so well authenticated as for the fall at Colby, Wisconsin, in July, 1917. Dr. O. C. Farrington made a personal investigation at Colby, interviewing the men who dug up the stone, and accepted as true the statement that frost formed on some of the pieces.

The most common spelling in articles on this meteoric fall is "Dhurmsala," but "Dharmsala" is given also, and the oldest reference available uses "Dhurmsalla." Atlases examined give only "Dharmsala," which is one of the important towns in the Kangra district of the Punjab, India. In 1855, five years before these stones fell, Dharmsala was made district headquarters for Kangra and became the center of a European settlement. "Dharmsala," Hindu for "religion," is a common word in India, and so the spelling is definite.

C. C. WYLIE.

University of Iowa, September 16, 1930.

The Perseids, August 12, 1930

While the shower of Perseids was barely a sprinkle, the meteors were of sufficient number and variety of direction to illustrate the radiant or area from which they seemed to emanate.

The sky was overcast the evening of the 11th when the event was scheduled to occur; but about midnight the curtain of cloud lifted in the south, and with that encouragement we went to bed. Since the constellation of Perseus rises late, we might get sight of it toward morning.

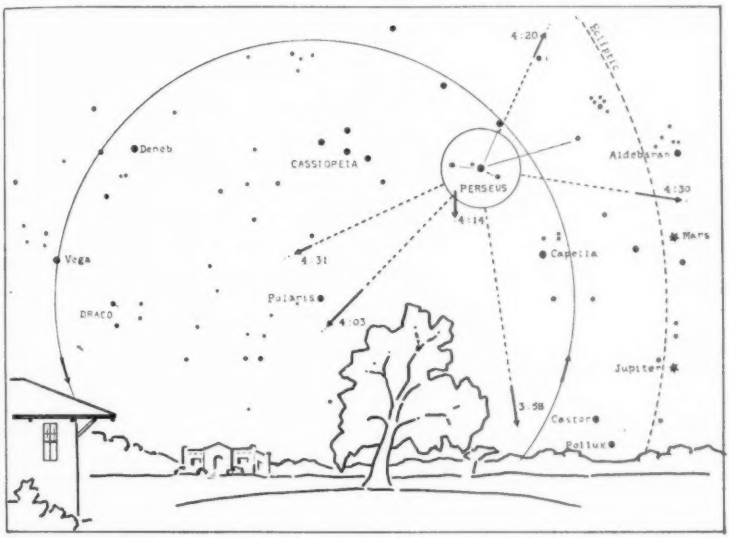
At a quarter to four, we awoke and looked out. The sky was clear and the moon was shining. We jumped into our clothes, seized a sheet of paper to jot observations on, and went out. Perseus was high in the sky with the clouds in retreat in the northwest. We selected a spot for observation from which we had previously taken a photograph of the Big Dipper, North Star, and the Big Oak. The bright moon at our back made sketching an outline of the tree easy, and enabled us to note the time and roughly plot the stars.

At 3:58 the first meteor fell; it shot earthward to right of the oak, and was visible for about half a second. Its tail was short. Five minutes elapsed. At 4:03, a shooting star flashed past Polaris. Nine minutes went by; a beautiful meteor shot across the sky southward bound above the Belt of Orion at 4:12. It flared up brilliantly at the finish, leaving a glowing trail. At 4:14, a short, sharp flash occurred under γ Persei, and at 4:20 another of longer duration grazed ϵ Arietis not far from the Pleiades. Dawn began to suffuse the east and a rooster crowed when the next meteor darted between Aldebaran and the planet Mars, following the same direction as the one above Orion. A minute later a short trail was seen on the opposite side of the constellation of Perseus, the meteor travelling in the direction of Draco's head. At 4:35 a bat flew into the oak. By 4:45, the lesser stars that give character to the constellations had vanished from sight in the growing light. No more meteors were seen and the shower was over.

Young suggests in his astronomy that a verse be repeated in order to measure the duration of flight of meteors. The text at top of the editorial page of the

San Francisco *Examiner* on the morning of our observations was "The heavens declare the glory of God; and the firmament showeth his handiwork." The trails were all relatively short. For the shortest, one had barely time to exclaim "heavens!"; for the longer ones, to say, "The heavens declare" and for the longest of the seven, to repeat "The heavens declare the glory of God." The meteors passed within our ken for a moment and were gone.

In order to get better acquainted with the shooting stars we plotted them on



a chart. The visible path in each case is shown by an arrow. When these were traced backward, they were found to emanate from the constellation of Perseus. This does not mean, however, that the shooting stars are fragments of that constellation. The meteors follow an orbit about the sun like a planet, and when some members of the swarm pass through the earth's atmosphere on their orbital route, they become visible and we see them against the background of stars. The August meteors have the constellation of Perseus for an apparent starting point. They are therefore called Perseids.

EDWARD C. DAY.

San Anselmo, California.

Meteor Observed.—A meteor was seen by my sister, Alice H. Byrd, at $9^h\ 30^m$, Central Standard Time. Referred to the moon, it was about 10° to the west, on a line parallel to the horizon, and its visible path extended 10° on this line prolonged.

Its characteristic feature was that, instead of one bright object, it consisted of a string of star-like bodies, about four or five in number, and half a degree in length. They were about equal in size and brightness, nearly as bright as the planet Venus. The meteor moved swiftly, and was visible approximately two seconds.

MARY E. BYRD.

Lawrence, Kansas, August 4, 1930.

Fireball Observation. — I was standing outside of my home on the night of July 4, about one-third mile north of the village of Christine, North Dakota. The moon was at the second day after the first quarter. I looked up at the sky to see whether I could split ϵ Lyrae in the moonlight. I saw a fireball, blue-white in color, about half as bright as the moon was at the time. It appeared within a degree or two of π Cygni and ended near Deneb. It remained visible perhaps five seconds and had an angular diameter of 15′. It left a train ten degrees long and about fifteen minutes wide, blue-white in color. This started to fade after twenty seconds. The center remained bright the longest. It took the train about a minute to fade from view. I went in and noted down my observations. The time of the appearance of the fireball was 10:05 P.M.

Christine, North Dakota, July 5, 1930. NOAH W. MCLEOD.

NOTES FROM AMATEURS

Swapping Stars. — On behalf of the 1777 Flag Committee, George Washington said that the original thirteen stars on the flag of the United States were taken from heaven.

This immediately raises the question as to how those, who love each of the 48 stars of Old Glory, out where the Milky Way is really milky, can secure personal introductions to their originals in the sky, in the absence of a nearby amateur outdoor astronomy club; or who, worse still, live too far from Chicago's wonderful indoor sky-show known as the Max Adler Planetarium. Easy enough! On the next clear night, prove your organizing ability by inquiring of any outdoor group, "Does any one know that bright star yonder well enough to introduce me to it?" Sooner or later, possibly later, some one will say, "I do not know that one, but I do know the Big Dipper. There it is right up there." If you happen to be acquainted with the Northern Crown or the sky airplane known as the Northern Cross, or any other group or constellation in sight at the time, at once say, "Now, won't you let me present my sky friends (naming the constellation)?" Then get that person to promise to get in touch with you just as soon as he, following your technique, meets other star-minded people and their sky friends. You be sure to do likewise.

Stamp collectors swap stamps right along; and you, by thus swapping stars, will in a short time secure two fine collections, one of stars and the other of very pleasing friends.

HENRY DILL BENNER,
Founder-Director of The Night-Sky Club.
77 Heller Parkway, Newark, New Jersey.

Looking at Stars with the Blind Spot.—It is an interesting experiment to center a bright star on the blind spot, and watch it disappear. Where the optic nerve leaves the retina, it necessarily takes up space which would otherwise be occupied by sensitive rods and cones, and thus leaves a non-sensitive "blind spot." This is generally treated in textbooks on physiology or physics, and the usual illustration is a pair of small, black circles, printed about three inches apart, which are to be held about six inches in front of one's eyes, with the line joining them parallel to the line joining the eyes. If one eye is closed and the other used to look at the circle in front of the closed eye, by moving the paper back and

forth a position is found where the other circle (seen by diverted vision) disappears, due to its image falling on the blind spot.

Since the sky cannot be moved back and forth, the trick is to find a spot at the correct angular distance from a star. For the average eye, this seems to be about 16 degrees. Take Vega, for example, and, having closed the left eye, use the right eye to look at a point about 16 degrees to the left of Vega (Albireo serves well). With a little practice, the proper point will be found where Vega will disappear entirely from the diverted vision of the right eye. The effect is entertainingly startling.

This idea was suggested, and note written, respectively, by

WM. MONNIG III and OSCAR E. MONNIG.

Ft. Worth, Texas, September 22, 1930.

GENERAL NOTES

Professor Florian Cajori, well known for his writings on scientific subjects, principally in mathematics, died suddenly of pneumonia on August 14 at his home in Berkeley, California. He was Professor of the History of Mathematics at the University of California since 1918.

Father John G. Hagen, S.J., who contributed the first article in the preceding issue of this magazine, after a siege of illness of some months died in Rome on September 6 at the age of eighty-three. For some years Father Hagen was director of the Geogetown College Observatory at Washington and for the last twenty years has been the director of the Specola Vaticana, an observatory within the Vatican in Rome. We hope to be able to publish a biographical sketch and an account of his astronomical work in the near future.

Professor H. H. Turner, Savilian Professor of Astronomy in Oxford University and Director of the Oxford Observatory since 1893, was taken ill suddenly on August 16 while presiding at the Seismological Section of the International Geophysical Union at Stockholm. His death followed on August 20. Professor Turner was one of the outstanding personalities among astronomers throughout the world. He was the invited representative of the British Association for the Advancement of Science at the meetings of the American Association for the Advancement of Science which were held in New York City in December, 1928, and delivered a lecture on the history of astronomy before the entire association at that time.

An account of his contributions to science, especially to astronomy, will be published soon in this magazine.

Mr. L. A. Redman, a lawyer who made astronomy his avocation, died in San Francisco on August 17, at the age of sixty-seven. Mr. Redman was well known because of his unwillingness to accept the recent developments of mathematical astronomy.

Dr. Heber D. Curtis, Director of the Allegheny Observatory, has been appointed Director of the Observatory and Head of the Department of Astronomy of the University of Michigan, and will assume his new duties on October 15.

Dr. Frank C. Jordan, who has been a member of the staff of the Allegheny Observatory since 1908, first as Astronomer and later as Assistant Director, has been appointed Director of the Allegheny Observatory, and Dr. Keivin Burns has been appointed Assistant Director.

Dr. Leslie J. Comrie, deputy superintendent since 1925 of the (British) Nautical Almanac office, has been appointed superintendent of the office in succession to Dr. P. H. Cowell, who has retired after twenty years' service. (*Nature*, September 6, 1930.)

Dr. J. S. Plaskett, director of the Dominion Astrophysical Observatory, has returned to Victoria after a trip through the United States and to England, during which he received the Rumford Medal and the medal of the Royal Astronomical Society. (*Science*, September 19, 1930.)

The Mathematical Association of America held its fourteenth summer meeting at Brown University, Providence, Rhode Island, on Monday and Tuesday, September 8-9, 1930, in conjunction with the summer meeting and the colloquium of the American Mathematical Society.

Astronomical Society for Amateurs in Chicago.—Stimulated by the great interest in astronomy engendered by the Adler Planetarium and Astronomical Museum in Chicago, the astronomically inclined members of the Pickwick Society have taken the initial step toward forming an organization for amateurs in astronomy in and near Chicago. They already have one 7-inch and one 10-inch reflector at their disposal, and two 8-inch reflectors are under construction. Dr. Philip Fox, director of the Planetarium, has been secured as general adviser, and Mr. John E. Mellish as technical adviser in telescope construction. Any one interested in joining this organization will be welcomed and is asked to address The Pickwick Society, 4653 Addison Street, Chicago, Illinois, care of the Astronomical Division.

The Astronomische Gesellschaft held its twenty-ninth biennial meeting in Budapest August 8 to 13. About one hundred twenty members from sixteen different countries were present. Some twenty papers were presented. Officers for the coming two year period were chosen as follows: President, Professor Max Wolf; Vice-president, Professor A. S. Eddington; Secretaries, Professors Guthnick and Prager; Treasurer, Professor Hopmann; Committee, Professors Kopff, Lundmark, and Tass. The next session is to be held at Göttingen in 1932.

United States Civil Service Commission announces an open competitive examination for the position of Junior Scientist (Nautical), salary $2,000 a year. The date of the examination is not stated but applications for the examination must be on file with the Commission in Washington, D. C., not later than October 21, 1930. The subjects included in the examination are Pure Mathematics, Navigation, Physical Geography, Nautical Definitions, and Steamship Management.

The Scientific American, for October, is designated as "astronomical number." One need not look far to see the appropriateness of this description. It contains very readable and informative articles by David B. Pickering, Russell W.

Porter, Clyde W. Tombaugh, Henry Norris Russell, and a photograph of Professor S. A. Mitchell, director of the Leander McCormick Observatory, University of Virginia, at which observatory more than one thousand parallaxes have been determined. The number contains numerous other papers, thus affording its readers sufficient material to occupy them for several hours most pleasantly and most profitably.

The French Astronomical Society has decided to award a medal of honor to the Lowell Observatory at Flagstaff, Arizona, as an expression of appreciation and admiration for the discovery recently made by the observatory of the trans-Neptunian body, preparation for which was made by the learned research of Mr. Lowell. (*Science*, September 19, 1930.)

Aurora Borealis Observation.—I would like to report a very brilliant Aurora Borealis which was visible over this city on the night of September 18, 1930. It was first observed about 8:15 P.M., E.S.T., and lasted about three-quarters of an hour after which observation could not be continued because the sky became obscured by heavy clouds. The first part of the dispaly consisted of several beams of brilliant green which played across the northern horizon followed by broad patches of greenish light which undulated to and fro. Along the edges these patches could be seen red, pink, yellow, and blue besides the green. The most striking feature was the great brilliancy of these greenish patches. I do not remember having ever seen such brilliant coloring in one of these auroral displays before, although such displays are by no means rare occurrences here. These patches of light soon faded to a much duller color but later lighted up several times to their former brilliancy. I cannot tell how long this lasted because the clouds soon obscured everything and kept getting denser so that I was unable to watch any longer.

G. McFarlane.

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Zodiacal Light Notes

Mr. V. Tshernov has communicated brief reports of twelve Zodiacal Light observations made between May, 1929, and April, 1930, at Oustimovka, Ukraine, 30° 3′ east longitude and 49° 19′ north latitude. Mr. Tshernov says that at Oustimovka in the evening the Zodiacal Light is best visible from November to April and in the morning from September to December. In November and December both evening and morning observations are possible but atmospheric conditions are not good during those two months. Following are extracts from his reports:

1929, May 1: Light very feeble; visible to Gemini, 75° east of sun.
Dec. 23: Light white with diffused boundaries; point of strong cone in Aquarius, 76° east of sun; point of feeble cone in Pisces, 107° east of sun.
1930, Jan. 21: Light quite clear with diffused boundaries; northern half of the cone clearer than the southern half; point of cone, 109° east of sun.
Feb. 19 and 22: Point of cone 86° east of sun; northern half of cone brighter than southern.
Feb. 27: Light much brighter than on Feb. 22, the whole cone, north and south, being equally bright; point of cone, 81° east of sun.
March 23: Light unusually bright with strong point of cone near Pleiades, 57° east of sun, and faint point of cone, 78° east of sun.
April 16: Light quite feeble, whitish, point of cone 61° east of sun.
April 28: Light more feeble than on April 16; point of cone in Praesepe, 92° east of sun.

On March 24 the Gegenschein was faintly visible at 1:00 A.M.

As a general comment on Mr. Tshernov's reports it may be said that in the latitude of his station the Zodiacal Light is less visible in extent than it is in mid-temperate latitudes and much less than in tropic latitudes.

Since his last report the writer has been unfortunate in making observations on account of continued cloudy weather on moonless nights. Attention was given to the northern luminosity mentioned in the preceding report. The following notes may be of interest:

July 15: At 10:20 the sky was partly cloudy round the northern area but the luminosity was seen here and there, particularly on the slant between Ursa Major and Leo; also extending below Polaris, but not so distinct as formerly east of the meridian.

July 24: At 10:00 P.M. sky was clear in the north except for dense haze along the horizon about 8° in altitude. Above the haze bank the luminosity was seen reaching from the Pointers almost to Cassiopeia but much fainter east than west. It was estimated that the luminosity reached, diffusely as to boundary, almost halfway to Polaris.

July 27: At 11:00 P.M. sky was clear and the luminosity was seen very faint east of the meridian, more distinct below the handle of the Big Dipper.

July 30: At 10:00 P.M. the luminosity was faint and diffuse extending about 15° above a heavy cloudbank skirting the northern horizon to an altitude of about 5°. While the luminosity was more distinct west than east of the meridian it was decidedly not so strong as a month ago.

Aug. 13: At 10:00 P.M. sky was sufficiently clear between Cassiopeia and Ursa Major to note the luminosity which is becoming increasingly fainter.

Aug. 18: At 9:30 P.M., very slight luminosity was seen below the handle of the Big Dipper.

The remainder of the possible August nights were cloud covered.

At 11:00 P.M. on July 22 a break in an otherwise fully cloudy sky was noticed in the zenith ranging from 30° to 35° in extent. In this break of clear sky the luminosity known as the "permanent aurora" was quite marked by sharp contrast with the blackness of the surrounding cloud-laden sky.

About ten years ago Yntema and Van Rhijn discussed the permanent aurora in the night sky and the view of it which the writer had was strikingly impressive.

W. E. GLANVILLE.

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Report on Aurora of May 30, 1930

The most spectacular display of aurora ever seen by the writer was noted here during the night of May 30, and early morning of May 31. It was undoubtedly seen at numerous points and comparisons would be interesting. Below is a summary of the activity.

10:20 Aurora first noted. A mere band of green haze.
10:43 Bright yellow band below Capella; beautiful.
10:52 Long streamer through Ursa Major, reaching to Theta Ursae.
10:53 Bands developing below Zeta Cassiopeiae.
10:55 Bands unrolling toward horizon; one going westward. Also a bright green band approaching from Perseus.
10:56 Streamers shooting up through Cepheus. Display now vivid.
11:12 A most prominent band just west of Capella, of a very intense, bright green. Unwinding toward east. Also a band in Perseus. (Band 7).
11:15 Narrow streamers resembling the spectrum, in Perseus.
11:16 Band No. 8 developing. Most intense at 11:18. Narrow and stationary.
11:16 Band No. 9 developing. Three distinct bands very bright, at 11:20. Faded then brightened at 11:22.

11:23 Band No. 10 developing to west and rolling eastward. Of a yellow tint. Band No. 9 a large hazy patch about Sigma Cassiopeiae.
11:29 Band No. 10 all the way across the north; about 3° broad, and narrow.
11:34 Band No. 11 developing 5° below the "W" of Cassiopeia. A great, hazy emerald patch.
11:38 Band No. 11 much brighter; unrolling to west.
11:40 Intensely brilliant—more so than the one of 11:12. Entire northern sky lit up like a flashing spectrum.
11:44 Aurora hazy; no bands or streamers. Fading.
11:48 Aurora commencing to flash and pulsate toward the zenith; streamers developing.
12:03 Pulsating and streamers at maximum. Reached as high as Tau Herculis at the zenith, Theta Leonis Majoris to the west, and into Lyra on the east.
12:12 Dying out. One prominent pulsation between Cepheus and Cassiopeia.
13:50 Observations renewed. Aurora exhibiting long, narrow streamers of weaving, prismatic curtains. A very pretty one at 13:55 turned upward and westward, then faded as it unfolded. The display seems much nearer now, and more majestic.
13:57 Display about thirty-five degrees high.
14:02 Dying out again.
14:03 Observations ceased.

May 31. Hazy auroral band noted throughout entire night, but apparently it failed to develop, only one straggling, pale streamer being noted through Ursa Major at about 11:15.

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BOOK REVIEWS

Astronomy, by Robert H. Baker. (D. Van Nostrand Company, Inc., 8 Warren Street, New York City. Price $3.75.)

A few years ago, there was a marked need for an up-to-date textbook suitable for the introductory course in astronomy as offered in the average college or university. This need undoubtedly caused many teachers to consider the writing of a text and several good ones have since appeared, but this is the first written especially for a non-mathematical but complete introductory course. In fact, in avoiding mathematical treatment the author has omitted points which many teachers will no doubt prefer to include, even in such a course. The selection and arrangement of material is, however, judicious, and the author has no obvious hobby. The printing is excellent, and the illustrations are well chosen and reproduced. The subject matter has evidently been worked over carefully, and the figures are neatly drawn.

The book is very up-to-date. For instance, "The outermost planet is more than forty times farther from the sun than we are, . . ." (The references to Pluto can be improved now.) The new Adler Planetarium, the proposed 200-inch telescope, and the Grootfontein meteorite are all included.

The book is relatively free from errors, but several were noticed, most of which will no doubt be corrected in future printings. Dr. Brouwer, in his review in *Science,* mentions some misstatements in the section on the variation in the speed of the earth's rotation. We will add some noticed in the section on meteors. On page 240 the author gives an interesting calculation of the number of meteors visible to the naked eye striking the earth, based on the estimate that "from one station, less than 1/10,000 of the atmosphere is above the horizon." His result is in error because of the assumption that one observer will see all of the meteors

in that portion of the atmosphere. It should, therefore, be multiplied by perhaps ten. The material on the fall near Homestead, Iowa, appearing on pages 247 and 248 is from a monograph by C. W. Irish, whose vivid description has been quoted almost verbatim by Farrington, Prior, and other modern writers. On page 252 the author has taken from Farrington the largest iron meteorite observed to fall and the lagest unbroken stone meteorite, but neither of these is now up-to-date. The weight of the large Knyahinya stone is given as 600 pounds, instead of the more accurate 293 kilograms, or 646 pounds. Some inaccuracies are, however, inevitable in the first printing when a large amount of new material is presented, and we believe that for classes without college work in mathematics or physics, no recent book is better fitted for the introductory course of five hours per week for one semester, or three hours per week throughout the year.

C. C. WYLIE.

University of Iowa, September 23, 1930.

Modern Cosmologies, by Hector Macpherson. (Oxford University Press, 114 Fifth Avenue, New York City. Price $2.75.)

This is one of the many books recently published in the field of astronomy, the science which in the last decade has engaged the thought of the reading public to an extraordinary degree. The author of this book has in earlier works in this field shown a facility in presenting the facts with which he is concerned in an interesting and readable manner. The book consists essentially of the material of a series of eight lectures delivered by the author at the Royal Technical College, Glasgow, during the winter of 1928-29. Although it is entitled "Modern Cosmologies," in the introduction we read of the earliest ideas on this subject, that is those of Thales, Ptolemy, and others. The first chapter treats of the Copernican idea of the world, and the subsequent seven carry the thought through the centuries to the date of publication, the final one giving a very satisfactory account of the evidence for an enormously expansive universe, providing ample space for countless "Island Universes."

Judging by the size of the book, 127 pages, one might undertake to read it through in a few hours, but one, on closer inspection, finds each page packed with fact and careful reasoning, so that it elicits one's best efforts and induces one to proceed slowly. Having given this volume the attention it deserves, one will be repaid in that he will have come into touch with the discoveries and the deductions from them which lead at least to some understanding and interpetation of the world in which he lives.

Astronomische Chronologie, by Dr. P. V. Neugebauer, (Walter de Gruyter and Co., Berlin and Leipzig.)

This work appeared in 1929 in two volumes. The purpose of it is stated in the first paragraph of the preface as follows: "This work sets for itself the task of bringing out all of the modern helps for carrying out the computation connected with the various celestial phenomena, and of explaining their use in so simple a manner as to make the amateur entirely independent of the assistance of a professional astronomer upon whom in many cases up to the present he has been obliged to call for aid." In the preparation of the work the author has constantly had in mind the service which it might perform in determining the dates of historical events for which the information is scanty. The author feels, and rightly so, that, if an event can be associated with some astronomical phenomenon,

its date can be fixed by astronomical computations more accurately than in any other way.

It is impossible even to list here the large number of topics touched upon in this work. The first twenty-eight pages of the first volume are designated the theoretical part. In these pages one finds definitions and explanations of the terms occurring in astronomy, something after the manner in which this is done in textbooks. The remaining one hundred forty pages of the first volume are called the practical part. Here one finds, for example, a discussion of the computation of the positions of stars and planets within long intervals of time. One example which is worked out (page 53) is the determining of the position of Mercury at six o'clock in the evening on October 27, in the year 7 B.C., at Memphis. Nineteen different main topics are discussed, such as the time of the moon's phases and the conjunctions of the planets with each other and with the fixed stars. The several computations are accomplished by means of tables of which the second volume is composed. These volumes contain much information whose value will not be minimized by the passing of time. It perhaps should be stated that this work is published in the German language.

Der Neu Entdeckte Himmel, by Robert Henseling. (Atlantis-Verlag, Berlin SW 68, Oranienstrasse 117, 118. Price 9.60 marks.)

"The Newly Discovered Heavens" is the English equivalent of the title of a book published early this year. The significance of the title is brought out in the first chapter which is entitled "The Lost and Regained Heavens." In the distant past before man fully comprehended the world he felt a certain familiarity with it. It consisted merely of his mundane experiences on a grander scale. Later this feeling of intimacy was lost and the heavens became the abode of mythological personages who lived in a different realm from his. Since the time of Copernicus and Galileo man has again built up a concept of the universe about him, this time with the aid of powerful and effective instruments. This new concept is set forth in this volume of one hundred twenty-four large sized pages in word and in picture. The exposition is simple, accurate, and interesting. The pictures are exceptionally well done. Excellent reproductions of photographs of the heavenly bodies made at most of the largest observatories throughout the world are included. An unusual picture shows the devastation caused in Siberia by a meteor which is reported to have fallen there on June 30, 1908. The pictures range all the way from this terrestrial view to the distant spiral nebulae.

Those who have the use of the German language at their disposal will find this book very entertaining and instructive.

Publications Received.—The publishers of POPULAR ASTRONOMY hereby acknowledge the receipt of the following named publications and express their great appreciation of the courtesy shown on the part of those who have sent them.

8. The Spectral Distribution of Stars Magnitude 7.0 and Brighter in the Henry Draper Catalogue, by Dr. Otto Seydl. (Publications de L'Observatoire National de Prague, Parts I and II.)
9. Results derived from 8600 meteor observations made during the years 1919-1925, by Charles P. Olivier. (Publications of the Leander McCormick Observatory, Vol. V, Part 1.)
10. Bibliography of Seismology, by Ernest A. Hodgson. (Publications of the Dominion Observatory, Vol. X, No. 2 and No. 3.)

11. A Spectrographic Study of β Cephei, by H. S. Mendenhall. (Lick Observatory Bulletin, No. 418.)
12. Elements and Ephemeris of Comet *d* 1929 (Wilk), by Ernest Clare Bower and Fred L. Whipple. (Lick Observatory Bulletin, No. 419.)
13. Spectroscopic Notes, by Keivin Burns. (Publications of the Allegheny Observatory of the University of Pittsburgh, Vol. VIII, No. 1.)
14. A New Type of Comparator, by Heber D. Curtis. (Publications of the Allegheny Observatory of the University of Pittsburgh, Vol. VIII, No. 2.)
15. The Eclipsing Variables WW Aurigae, W Ursae Minoris, by Raymond Smith Dugan. (Contributions from the Princeton University Observatory, No. 10.)

A SONG FOR HALLOWE'EN

You'd better draw the door-bolt,
And look what you're about;
The goblins will catch you
If you don't watch out!

A thousand murky goblins
Are loose upon the air,
Are frisking diabolically
Above the Little Bear,
Are dropping from the Swan's wings
And coasting down the Dragon,
And tipping up the dipper
As though it were a flagon;
And now they're climbing up the sky
And perching on the Lion,
Or shaking flakes of silver
From the sword of Old Orion,
And leaping unto Pegasus,
An dswinging from his tail,
And scattering the Pleiades
Like bits of shining hail.

You'd better pull the curtains down
And make the shutters tight;
A thousand murky goblins
Are loose upon the night!

—Jane F. Boone.